FARMERS DIGEST

Volume 12 MARCH, 1949 25¢ a Copy
Number 10 $2.50 a Year

The Philosophy of Balanced Farming ..... *Journal of the A.S.F.M.* 1
Production Testing Pays ..... *American Hampshire Herdsman* 5
The Right Rotation for Your Farm ..... *Iowa Farm Science* 7
Grow Your Own Feed ..... *The Furrow* 13
Rope—Its Uses on the Farm ..... *Rural New Yorker* 16
Skunk Odor Routs Rats ..... *Better Farms* 20
Profitable Pastures ..... *Guernsey Breeders Journal* 22
Broiler Profits ..... *Poultry Tribune* 26
More Pork an Acre ..... *Capper's Farmer* 30
Should We Stop Cultivating? ..... *Frontiers of Plant Science* 32
New Things on Agricultural Lands ..... *Soil Conservation* 35
Man-Made Weather Miracle ..... *N.J. Farm and Garden* 41
What's New in Poultry Nutrition ..... *Everybody's Poultry Magazine* 43
Legumes Supply Organic Matter ..... *Better Crops with Plant Food* 47
Nitrogen for High-Protein Corn ..... *Ohio Farmer* 53
Lambing Time ..... *Sheep Breeder* 56
Vermiculite—Magic Substance ..... *Seed World* 61
Kansas Good Will ..... *Extension Service Review* 64
Destroy Those Grubs ..... *The Farmer* 66
The Beef Steer ..... *American Hereford Journal* 68
Help in Selecting Feeds ..... *Successful Farming* 73
Orchard Mulch ..... *Michigan Farmer* 76
Shade Trees for the Farm Home ..... *Pennsylvania Farmer* 78
Blast-Furnace Slags have Liming Value ..... *Farm & Home Research* 82
The Physical Structure of Soil ..... *Organic Gardening* 84
Hardening Plants with Potash ..... *Farm Research* 90
Churches That Farm ..... *Farm Journal* 93
Index 95

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The Farmer's Digest
Published Monthly except September at Ambler, Pennsylvania
by the Farmer's Digest, Inc.

25¢ a Copy *1 Year $2.50*
3 Years $4.50 *5 Years $6.50*
Foreign Subscriptions $3.00 a Year

Entered as second-class matter at the Post Office at Ambler, Pa., July 30, 1942, under act of March 3, 1879. Additional entry at Lancaster, Pa.

The Farmer's Digest

Volume 12 March, 1949 Number 10

The Philosophy of Balanced Farming

Condensed from the Journal of the A.S.F.M.

J. W. Burch

Director of Agri. Extension Service, Univ. of Missouri

THE underlying idea beneath the Balanced Farming Program in Missouri is that it is just as essential to have a sound plan for a farm as it is to have a blueprint for the construction of a building. Balanced Farming is farm management in its broad sense. It calls for the establishment of a farming system that will make the best use of the resources of land, labor and capital available for a particular farm. It calls for a system that will give the highest net income that is consistent with the continued improvement of the soil.

The Agricultural Extension Service in Missouri is putting practically its entire resources behind two major programs: the 4-H Club Program and the Balanced Farming Program. We are doing this because that is what the farm people of the state tell us they want us to do; and furthermore, in our judgment these are the two most important programs that could be established for any state. For many years we taught individual practices through single demonstrations on farms. On one farm we demonstrated the growing of red clover, on other thrifty pigs, on still another how to improve the farm kitchen. The Balanced Farming Program is an attempt to tie all these sound, helpful recommendations of the College of Agriculture together into an integrated program for a particular farm. We now have some 16,000 farms following a Balanced Farming Plan. And there are many thousands more who have developed modified Balanced Farming Plans of their own from the example of their neighbors who have formal plans set down on paper.

It is part of the philosophy of

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Balanced Farming that the major objective must be a better farm family living. It is not enough to say that given good farm management you will get higher income and that automatically will provide a better living. We believe that at the very outset the plan should be figured through with the family to show about how much income they can expect using prewar prices. This procedure will in most cases necessitate intensive farming for the families with relatively small holdings. A comparison of the expected income with the desired expenditures has convinced many an owner of a small farm that he must change over from general farming and handling of beef cows to dairying and poultry production. But in addition to the absolute necessity of establishing the highest net income possible, planning the farm home for utility, comfort and beauty is of utmost importance. We have often said that woman power is the most expensive power on the farm. The thousands of farm women who grow old before their time caring for a good sized family and doing their part of the hard work on a farm, without such conveniences as water, lights, storage room, etc., constitute a great economic and social loss.

Modern conveniences in a farm home make possible real savings on food and salable, perishable farm products. This is particularly true in connection with selling dairy products, eggs, truck crops, etc. The saving on food used for the family where proper refrigeration is available is a sizable item.

A plan for landscaping and beautifying the homestead can be worked out quite inexpensively and will yield tremendous returns in pride and satisfaction for the farm family as the years go by. This pride in the home returns real dividends in terms of cooperation that may be expected from the children in connection with the entire farm and home program. Careful budgeting for food, clothing, schooling, medical and other expenses presents a realistic picture to the family that, if properly worked into the overall farm plan, allows the whole program to move forward smoothly and efficiently.

Perhaps one of the most compelling reasons for the Balanced Farming Program comes from the ever present demonstration on most farms of a lack of balance between the livestock and the crop enterprises. It is almost a tragic joke that in general the individual termed a "livestock man" is one who gives all of his attention to his livestock but fails to provide adequate pasture and roughage. Consequently, he has to buy these feeds as well as grain and has very little net income left at the end of the year. The counterpart is the man who likes to handle ma-

chinery and grow crops. He works frantically through the season to produce a considerable amount of corn and then wastes half of it feeding low grade and unthrifty livestock. It is, of utmost importance in this state, where the sale of livestock and livestock products constitutes around 80% of the total sales made by farmers, that we constantly strive for the improvement of our pastures and for a balance between the number of livestock and the number of available pasture days. And we must constantly try to lengthen the grazing season. This sort of farming does not happen. It comes only where a farmer has a plan, either on paper or very firmly fixed in his mind. It would be absurd, of course to think for a minute that we did not favor the purchase of additional feed wherever a sound plan indicated that it could be turned to additional net income. An occasional individual has assumed that Balanced Farming meant that you would handle only as much livestock as your own farm-raised feed supply would permit.

For many years we have recognized the importance of careful sanitation, particularly in the production of pigs and chickens. We have all finally recognized that this job simply will not be done upon a farm unless there is a plan that provides for the necessary fields, with probably a corn—small grain—clover rotation that will provide pasture, then the plowing and cultivation throughout one summer that makes for clean ground. Such fields must be fenced properly and must have water available. The garden-poultry lot rotation is becoming a reality, and a very practical one, on thousands of farms in this state.

Probably the most important bit of philosophy in the Balanced Farming Program is that soil improvement or soil conservation is not a thing that can be established by itself. The water management plan that provides for erosion control must be fitted into the crop and livestock program if it is to succeed and if it is to be carried out over the years by the farmer and this is most important if it is to be paid for. Most of us agree that the conservation of our national resources, of which soil is the most important, must be of concern to the national government. We believe that in general some incentive payments are desirable to encourage farmers to start improving their soil. But as time goes on, we recognize the very real private investments needed for terracing, liming, and the addition of fertilizer on our better farms in order that we may get maximum production and improvement of the land year by year. With the present national debt plus our commitments in connection with European re-

covery most sane individuals recognize that the contribution our National Government can make, in the way of soil building payments to each of our 6 million farmers, must be relatively insignificant in comparison to the needed yearly outlay on these farms to keep them producing enough for a reasonable standard of living for a farm family and at the same time build up the land. Real farm leaders should, therefore, turn the spotlight of public attention to the contributions of the individual farmer as being the major contribution with less attention to the minor contribution made by the Government. From the standpoint of recognition and attention to these relative contributions we have let the "tail wag the dog too long."

It is, therefore, a part of the philosophy of Balanced Farming to encourage self reliance and the idea that the individual who is going to succeed is the individual who does things for himself. This type of philosophy still leaves room for a long-range farm program with emphasis on soil improvement. We believe such a national program should require the farmer to have some type of a plan. It would be necessary at the outset for these plans to be pretty simple such as could be made by the farmer himself after community meetings with the county agent. More and more farmers could, however, have real farm plans such as those worked out by members of this organization for the larger farms, and by the county agent for the rank and file in cooperation with the farm operator. It would be exceedingly helpful if the incentive payments could actually be made to help do the things that the farmer's plan called for. In this way we get maximum soil improvement returns for each dollar of Federal money spent and the funds would be tied into the overall farm program in a way so as to encourage real and continuing contributions by the farm itself towards a high degree of permanent productivity.

It is also part of the philosophy of the Balanced Farming Program to encourage private enterprise. This is perhaps another way of encouraging self-reliance. The growth of the Balanced Farming Associations, of which there are 32 in operation in 1948 as contrasted to 1 in 1946, is another evidence of the philosophy that people prize those things for which they themselves pay.

Summarizing the points we have tried to make, the philosophy of the Balanced Farming Program is based upon the belief that:

(1) A sound farm plan is essential to success in the management of a farm as is a

blueprint for a good building.

(2) The major objective is better farm family living upholding the dignity of the individual.

(3) A plan for soil improvement alone is not realistic. It must be fitted in with the crops and livestock in order that it will work and can be paid for.

(4) A farm plan is necessary for thrifty, profitable livestock.

(5) Any National farm program should base incentive payments upon the individual farm plan.

(6) Self reliance is as important as ever. We will have national soil conservation only when the individual farmer accepts the responsibility of improving his own land and views governmental assistance as a minor contribution.

Production Testing Pays

Condensed from American Hampshire Herdsman

W. N. McMillen and H. F. Moxley
Michigan State College

ONE prolific sow with enough udder sections and milking ability to raise 10 or more pigs can produce litters with as much weaning weight as 3 average sows. In the Michigan Sow Testing Project from 1945–1947, with records on 872 litters, the 10 high sows produced more pig weight at 56 days than the 30 low producers each year.

Records for the sows in the College herd also emphasize the large variation in the producing ability between strains as well as between individual sows. A low producing strain had an average of 8 pigs born and less than 6 raised per sow over a period of years. A more prolific strain, handled under the same conditions, farrowed an average of 9 and raised just under 8 pigs per sow.

Not only do the prolific sows with good milking ability produce 3 times the weaning weight of average sows but they can easily be 3 times as profitable. It takes about 4 pigs at weaning time to pay the overhead production costs. A sow that weans 10 pigs has 6 to show for profit, while the sow producing 6 pigs has only 2 on the profit side. The labor,

Reprinted by permission from American Hampshire Herdsman, April 1948. Peoria, Illinois

equipment and feed costs per pig produced are considerably less for the high producers.

Some still say that they would rather have litters of 6 to 8 than to have the runts in larger litters. There may be a few more runts in litters of 10 to 13, but the records do not bear out the idea that pigs in large litters average lighter at weaning time. It can be seen from the tests that the average weight per pig changes little as the number of pigs raised per litter increases. The pigs in litters of 6 or less averaged 32.4 pounds at weaning. The pigs from litters of 10 or more raised averaged 32.8 pounds.

As a rule, the breeder or commercial hog man who raises large litters also takes better care of his hogs. Production testing has proven valuable in school and extension project work because improved breeding, feeding and management practices are all a necessary part of the program. Breeders can use the Michigan production data as a yardstick to measure the efficiency of their production programs.

The following points have been found to be essential:

START WITH HIGH PRODUCING STRAINS—It is foolish to keep sows that will farrow less than 8 pigs and raise less than 7 under good management. If you have an unprolific and poor suckling strain, the quickest and surest way to increase production is to discard the unprolific breeding stock and start with proven higher producing breeding animals.

WATCH THOSE UDDERS—A sow cannot raise a litter of 11, 12 or 13 pigs unless she has enough udder sections with teats properly spaced to accommodate that many. I recently received a letter from a man who wants to know how to raise orphan pigs. He has a sow that always has 12 or 13 pigs but has udder accommodations for only 9.

CARE IN SELECTING THE HERD BOAR FOR PRODUCTION FACTORS—Three times in the authors' experience a boar selected largely for type has wrecked plans for production. In two cases the boars had only 11 teats, and since the back two were small and close together, passed the equivalent of only 8 or 9 teats on to their daughters. Another boar with 3 blind teats passed 3 or more on to practically all of his daughters. A good many of the breeders who are now testing their sows are making slow progress because they fail to insist on boars out of high-producing dams that have at least 12 sharp, well defined teats properly spaced.

DON'T BE IMPATIENT—One should realize when he starts production testing that progress is slow at best. Analysis of data

concerning the hereditability of production factors indicates that one cannot expect to make rapid progress in increasing prolificacy and suckling ability. It has been demonstrated in several herds, however, that by consistent selection of boars and gilts out of large, heavy litters one can gradually increase the average number of pigs raised and the suckling ability of the sows.

The Right Rotation for Your Farm

Condensed from Iowa Farm Science

E. O. Heady, G. M. Browning, and R. W. Worcester
Iowa State College

How much hay and pasture should you raise? What kind of rotation will work best on your farm? Lots of farmers, both new and old wrestle with this problem each year. The answer is not a simple one.

Some people maintain that the value of an acre of forage in rotation is no more than its cash value—price per ton for hay, rent per acre for pasture. Others, equally in error, credit forage pasture with the full returns from livestock raised on pasture.

Both lines of reasoning have elements of truth. But "elements" of truth are not enough.

We will not find any single "best" combination of forage with other crops in a rotation, even for the same soil conditions. For each farm there is a separate answer to the question. "When does it pay to grow forage—when does it not pay?"

To find some useful measure of when forage is profitable in the rotation we must think in terms of "profit principles." Such principles will obviously consider prices and the use of crops for livestock feed, as well as the need for a "continuing high level of production. If we find the correct profit principles then we can apply them to the actual conditions on any particular farm.

So let's look at some of these profit principles that apply to growing forage crops. The principles should give us some guide; they should help us decide when it is profitable to raise more or less forage in the rotation.

Forage crops do three impor-

Reprinted by permission from Iowa Farm Science, November 1948, Ames, Iowa

tant things on our farms. They improve the soil, both by building up the structure of the soil and by adding nitrogen and organic matter to it. They help cut down erosion losses where that is a problem. They also make excellent feed for livestock. Few farms could do without some roughage feeds.

The value of forage crops as feed is partly shown in the price of hay and in the rent for pasture. Farmers don't often buy or sell bulky forage feeds unless they're obliged to. But hay and pasture do have a cash market. And in a general way prices represent the value of these crops as livestock feed.

The price of hay in the market does not, however, include the value of your forage crop as a soil builder and erosion stopper. These two kinds of "production" are often overlooked because they stay on the farm; they aren't ordinarily bought or sold.

Yet the root systems which add nitrogen and organic matter to the soil, boosting the yield of corn and other crops which follow, are a very real kind of production. They are "production" from your forage crop just as surely as the hay you bale or the pasture your animals graze are production.

Also, if the soil on your farm washes away easily when it rains, then the erosion that your forage crops prevent is production too. It may be hard to measure, but a few tons fertile topsoil washed down the river can mean you've lost part of your future crop yields.

Farmers generally recognize the soil-building qualities of forage crops. Yet they know that an average acre of forage produces less in feed value than an average acre of corn. Therefore we must find some balance between high producing corn and soil improving forage in the rotation.

Such a compromise will depend largely upon three relationships:

(1) The effect that grain and forage crops in rotation have upon the yield and production of each other.

(2) The amount of forage crops you can substitute for grain in feeding livestock.

(3) The price of grain compared with forage and the cost of producing each.

These will help us determine what combination of forage in the rotation will be most profitable.

Up to a point—adding forage to the rotation will increase the total amount of grain produced from your land. Land planted to grain crops year after year doesn't produce very high yields. On most land, when you first add some forage to the rotation the total production of corn and small grain is raised; you produce more total

grain from less acres planted to grain.

This is what we call the "complementary" relationship. At one extreme is the practice of raising continuous corn, or no rotation at all. Then there is a combination of forage with grain in rotation that gives you the highest possible grain output from your land.

Within this range, from continuous corn to the rotation that gives most grain, forage is "complementary" with grain. Increasing the forage in your rotation also increases the total production of corn and small grains.

It works like this. Suppose you have 100 acres of cropland. Suppose that if you raise corn year after year, it averages 30 bushels per acre or a total of 3,000 bushels per year. Suppose that by planting 10 acres of the 100 to clover each year you raise the long-run yield to 35 bushels per acre (corn or corn equivalent). Your total grain output is now 35 times 90 or 3150 bushels of corn from your 100 acres. In terms of grain alone it paid to grow the forage.

If adding 10 more acres of forage boosts yields to 40 bushels per acre, you are still in the complementary range: 40 times 80 acres makes the total 3200 bushels from your land.

Many farmers probably operate in this complementary range today: They could increase their long-grain output by raising more forage.

There's a very important principle here: You can never afford to raise less forage than will give you this highest output of grain. Even if forage has no cash or feed value on your farm you can still plow it under as green manure and reap higher grain yields from the added fertility. Costs then may be lower on the acres you have in forage.

Landlords operating under crop-share leases sometimes restrict their tenants' acreage of hay and pasture. But it will never pay a landlord to restrict forage acreage below the amount that gives highest grain output. A landlord could afford to let the tenant raise that much forage rent-free rather than restrict acreage. The increased total grain output will give both landlord and tenant a higher return.

Our "principle" doesn't tell us exactly what this high grain output combination of grain and forage is. That depends upon the conditions on your farm.

Some soils can stand a good deal of grain cropping. Others may need a high proportion of forage crops in the rotation to maintain high grain output over the long run. Some soils have a reserve or fertility that will support heavy cropping for several years in a row. Sooner or later,

however, organic matter, structure and nitrogen have to be returned to the soil if long-run productivity is to be maintained.

Sooner or later—as you include more forage in the rotation—forage crops become "competitive" with grain. Grain yields continue to increase with added forage. But the increase in grain yields is not large enough to make up for the loss in acres planted to grain.

This relationship begins with the rotation giving highest grain output. It remains competitive as you shift to more and more forage in the rotation.

Including more forage in the rotation now reduces your total output of grain. But total production in terms of feed units may continue to increase. (One feed unit is the feed equivalent of 1 bushel of corn based on total digestible nutrients.) How much and how long total feed production rises depends on soil types and growing conditions.

Total feed output goes up as long as each acre of forage added to the rotation produces more feed units than you lose from the drop in total grain output.

Then, as more and more hay is added to the rotation, grain yields get less boost from the added forage. Some rotation gives you highest total feed production including your forage yield. Beyond this point, including more hay in your rotation may lower the total amount of livestock feed produced.

Where moisture is a problem, or where spring floods add new fertility to the soil each year, forage may always be competitive with grain even over the long run. Here the operator need only think in terms of the competitive principles outlined.

For any single year grain and forage will always be competitive —the more forage you raise the less grain you can produce in that year. Thus tenants operating under one-year lease often raise mostly grain. Under such agreements they stand to gain nothing from the fertility benefits of forage.

Grain and hay crops first become "competitive" with the rotation giving the highest total production of grains. As hay is added, total feed production increases (and grain output declines) up to the rotation giving maximum feed production. With this rotation the feed produced from an added acre of forage exactly equals the grain output lost by the change. As the proportion of hay is increased beyond this point, total feed production as well as grain output goes down. The end of this range is complete grassland farming.

Here again we are speaking in terms of principles. These general relationships apply to all farms.

But the exact rotation that gives highest output of total grain or total feed may be quite different for each farm. No two farms will be exactly alike.

On some land you may even get highest feed production in terms of feed units from continuous forage. On other land it may be with the highest grain output. Total feed units alone is not a measure of the best rotation for your farm.

Changes in weather and other circumstances make it pretty difficult to tell just what is the "best" rotation for your farm. In a poor corn year it pays to raise more oats and hay. The 1948 crop season was a good corn year, hay didn't do so well because of winterkill. So it would have paid farmers to raise more corn than usual in their rotations.

But rotations can't be planned that way. We don't know ahead of time what the weather will be. Farmers have to plan their basic rotations for average long-run conditions, then hope for the best.

Nevertheless, as principles, we have these two fundamental relationships between grain and forage in every rotation: Grain and forage are "complementary" up to a point of maximum grain output; beyond this the added forage becomes "competitive" with the grain.

Under no circumstances will it ever pay to use a rotation with less forage than will give you maximum grain output. It will always pay you to operate in the competitive range.

Farmers are often advised to use the rotation that gives them their highest output of feeds in terms of feed units. And, as a general rule, this is good advice. It will usually pay you to produce fairly close to this point. It may not be the "most profitable" combination of crops on your farm, however.

The substitution of crops for each other as livestock feeds and prices of grain and forage crops both affect this "best profit" combination of crops on your farm. Our job is to find out what combination of crops produces the highest profit, whether you sell crops for cash or feed them and market them through your livestock.

Most Iowa farmers market their crops through livestock. Each type of livestock produces most efficiently when fed a particular combination of feeds. Sheep and dairy cattle use large amounts of roughage; hogs and poultry use more grain. And for any particular combination of livestock enterprises on your farm a certain overall combination of feeds gives most efficient production.

Since most farmers raise several types of livestock, numbers of each

can be juggled somewhat to use the feeds you produce efficiently. Also, feeds substitute for each other within limits. Most livestock can use some roughage in place of grain (or grain for roughage) without lowering efficiency very much.

This is efficiency in a physical sense. It means getting the most pounds of meat from the fewest feed units of crops. Although it is an important principle, it does not always give us the best income. Rather it is getting the most dollars worth of product from the fewest dollars worth of feed that brings in the highest income.

Prices of livestock as well as of feeds must be considered. Risks, labor and capital needs, and many other adjustments of your farm business enter in.

If crop prices were your only guide, you would produce a combination of hay and grain that would give you the highest income from sale of both.

And this is a fairly good yardstick, even for livestock farmers. Prices fluctuate a good deal from year to year. But in the long run they represent the value of the various crops as livestock feed fairly well.

Thus over the past 20 years the price of a pound of grain has averaged about 2½ times the price of a pound of hay. (The 1928-47 average price for corn was $1.00 and for hay $.40 per 100 pounds.) At this price relationship you would plan a rotation to yield an average of 2½ times as much hay per acre as corn—measured by weight.

Thus if by increasing your forage acreage you get back only 3 tons (6000 lbs.) of hay for each 50 bushels (2800 lbs.) of corn you give up, then you would be giving up $28 of grain and getting back only $24 in hay. If on the other hand, you get back 4 tons (8000 lbs.) of hay in place of 50 bushels (2800 lbs.) of corn by increasing your hay acreage, then you are exchanging $32 worth of hay for $28 in grain.

Using prices in this manner tells you what combination of crops will give you the highest dollar value of production. If you make allowances for your harvesting and other costs, this method can show you which rotation gives the highest net income in terms of cash prices.

The cash grain farmer will always use this method—bushel for corn and oats, and price per ton for hay or rent per acre for pasture. Livestock farmers too can use this measure. Most farmers plan to use their crops as feed for livestock. If prices are out of line with your own feed supplies, you can often sell one kind of feed and buy back another in order to get the most economical combination of feeds.

The kind of forage you grow in rotation is perhaps just as important as the amount. High quality alfalfa-brome mixtures not only produce lots of feed, they give a big boost to the yields of other crops. Thin stands of grass forage, on the other hand, may not add much to production.

Clovers, alfalfa and other legumes are the only crops that take nitrogen out of the air and store it in the soil. Legumes also add large amounts of organic matter and improve the structure of your soil. The "production" from these crops—production both above and below the ground—will be improved by proper use of lime and fertilizers.

Where erosion is a problem, raising forage may not always be the most economical way to hold your soil. Terracing, strip cropping and other practices may give you the needed erosion control. Then you could use a more profitable rotation on the same land without serious soil losses.

The principles we have talked about can help you find the right rotation for the particular conditions on your farm. There's always a rotation that gives you the highest grain ontput. In the long run you'll never gain from producing less forage than this rotation calls for. There's also a rotation that gives you the highest output of feed.

By careful figuring you probably can judge about what these rotations are for your farm. Then, on the basis of prices, feeding efficiency, and the organization of your farm business, select the rotation which you think offers the most profit in the long run.

Grow Your Own Feed

Condensed from The Furrow

F. E. Charles

If you have a small farm and a good many head of livestock, you either have to buy feed or make what you grow go a long way.

Daniel Moore does both on 108 acres near Bettendorf, Iowa, yet the way he stretches home-grown feed makes up for the farm's small size, and all but eliminates feed buying. The secret of his success hinges on year 'round use of his feed mill.

Using the mill constantly

Reprinted by permission from The Furrow, Nov.-Dec. 1948, Moline, Ill.

stretches out the value of both small grain and roughage grown on the farm. The result is that Mr. Moore doesn't buy much except concentrate feeds, and some minerals which he can't grow anyway.

Here's a sample of stretching alfalfa hay almost to the breaking point:

Iowa's corn crop, including Mr. Moore's, was hard hit by a wet Spring and drouthy Summer last year. Moore just didn't have the corn to feed, and he figured it was too high priced to buy. He had 51 head of fall pigs that had to be grown to market weight some way. Fortunately, he was able to buy high-quality alfalfa hay from a neighbor, at a reasonable price. When the pigs were weaned, he put them on a hay and concentrate ration.

Here's the way it worked. Moore would run 900 pounds of the alfalfa through his feed mill, using a fine screen. He then added 500 pounds of hog concentrate. Mixed well, the milled alfalfa hay and concentrate were fed to the pigs in a self-feeder.

The pigs liked this ration, and that's all they had until they averaged 150 pounds. They were then finished out on the same mixture, plus ground ear corn. The best of the pigs were topped out at 5 months, and the last of them at just over 6 months. They averaged 200 to 230 pounds and brought the market top.

"I figure we got out of our corn, all there was in it," Moore remarked. "We ground the ear corn fine so that the pigs ate every bit of it—cobs and all."

The purchased hog concentrate, which Moore feeds, contains the following:

Crude protein	32.0	per cent
Crude fat	3.0	" "
Crude fiber	6.5	" "
Nitrogen free extract	30.0	" "
Calcium	2.9	" "
Phosphorus	.85	" "
Salt	1.6	" "
Iodine	trace	

Much of the time, Moore's brood sows get little or no corn, but when they do, they also are given ground ear corn. "I figure the bulk of the cobs is good for them," Moore says.

When it comes to raising chicks (cockerels for broilers and pullets for a 300-bird laying flock) the home-grown, home-ground feed also saves on feed cost. To start his chicks off last Spring, Moore milled a ton of chick feed by this formula:

Corn	800	pounds
Oats	300	"
Choice alfalfa	100	"
Bran	200	"
Shorts	100	"
Baby chick concentrate	500	"
TOTAL	2,000	"

That batch of feed cost $97, at actual market prices of ingredients used. "The same commercial feed would have cost me $125," Mr. Moore explained, "which meant a net saving of $28 a ton. To bring the chicks to sale or laying age, required another two tons, so I saved about $84 by grinding and mixing my own feed."

The savings go right on when the pullets begin to lay, because they get more home-processed feed: ground oats, shelled corn and alfalfa, plus a commercial laying mash. The laying flock is Mrs. Moore's project. She has noticed that every particle of the finely-ground oats is eaten by the 300 Austra-White layers.

The big money crop on the Moore farm is milk from a herd of 15 Guernsey cows. Here again chopped roughage and ground home-grown grain make up the ration that supplements pasture. The 110 Duroc pigs pasture on 14 acres of alfalfa. Being short of acreage, Moore has to use that same pasture to furnish three cuttings of alfalfa hay. All the hay is field-chopped and blown into the dairy barn.

Moore has 38 acres of corn, including 6 acres with beans sown in the corn row for silage. He figures that 6 acres fill the silo that way, where it takes 9 acres of corn alone. Like the hay, the silage is chopped in the field.

The feed mill has a steady job grinding for the Guernsey cows and calves. Here's the grain-concentrate formula for a ton:

Ear corn, ground	1,000	pounds
Oats, ground	500	"
Oil meal	200	"
Bran	300	"

To each ton of this mixture, he adds 10 pounds of mineral supplement.

That grain mixture, plus grass, chopped hay and silage turns out Grade A milk, for a regular and profitable source of revenue.

Mr. and Mrs. Moore are relatively new on their present farm, as he is a veteran of World War II. But his experience at dairy farming runs back to prewar years, when he learned that half the battle of livestock farming is in keeping expenses down. In this postwar, high-feed-cost era, that seems doubly true, and Moore thinks he has the right line on feed cost control.

The theory that he puts into practice is this: grow your own feed and then feed it all.

Rope—Its Uses on the Farm

Condensed from the Rural New Yorker

Walter S. Chansler

EVERY farmer uses rope in some way. He may use it as hay rope, for block and tackle riggings, derrick hoists, guy ropes, or for making halters or handling heavy timbers. Small rope and cordage are often used for packaging, temporary repairing, and similar purposes. To get satisfactory service from rope in such a wide variety of uses, one should select the proper size and quality for any specific job, and one should know something of the nature and care of rope, how to prevent its breakage and deterioration, as well as how to tie various kinds of knots and make hitches and splices.

Under adverse conditions rope deteriorates quickly. Its life can often be materially lengthened, however, by giving it proper care and attention. Improper storage or storage under unfavorable conditions may do great damage to rope fibers, causing them to rot or deteriorate rapidly. Never, for example, store rope which is wet or even damp; and never let wet or damp rope freeze. When rope is not in use, keep it on a slatted platform where the air can circulate about it freely, or hang it in loose coils on wooden pegs. Keep it out of the sun as much as possible. Coil the rope in a clockwise direction when storing because this tends to untwist the strands, and prevents kinks. Always store rope where it will be safe from mice and rats.

Rope should never be exposed to the action of acids, chemicals or strong fumes, such as are likely to attack and damage the rope fibers. Disinfectants, manures and fertilizers are particularly harmful to such fibers. Ropes should be loosened during rainy weather when in use and under strain between fixed objects outdoors. They should never be dragged over rough surfaces nor through sand, dust, or cinders. Avoid overloading a rope or pulling it over or around sharp corners. Do not try to get rid of kinks in a rope by pulling them out, instead unwind the rope while it is slack, then apply strain again slowly. Tarring a rope will protect its fibers from excessive wear and rot when working it in wet places or during rainy weather. The frequent inspection of a rope, when

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333 West 30th St., N. Y. City

in use, for damage or deterioration of its fibers is advisable. One way to help avoid troublesome kinks in new rope is to uncoil it in a counterclockwise direction, starting with the end at the center of the coil. If the new rope is a long one and seems to unwind from the original coil in a kinky condition, it may be straightened quite readily by dragging it over a meadow or a pasture behind a wagon or a truck. Kinks in a short rope may easily be taken out by suspending the rope from a beam and fastening a light weight to the lower end. Great tension on a rope will cause undue surface and internal wear, especially when that tension is applied and released repeatedly on ropes running over pulleys, such as hay, or block and tackle, ropes. For these uses a rope should be of such size as to carry the load easily, and should be free from all kinks. It should also run through pulleys that have sufficient diameter and groove to prevent chafing and excessive wear.

Anyone using ropes frequently will find it necessary to make occasional repairs: relaying untwisted rope, whipping rope ends, laying in new strands, splicing, and the like. It should be remembered that in making rope repairs a good splice has from 80 to 90 per cent of the full strength of the original rope, while a knot has only 50 to 60 per cent. Splices, therefore, are the logical remedy for breaks in ropes. A single broken strand however, can be replaced by laying in a new strand of the same size at that point, thus avoiding the necessity of making a complete splice. In such a case, unlay each end of the broken strand for the distance of six or eight turns. Procure a strand of rope of the same size and long enough to make 20 or more turns about the rope to be mended. Lay this strand in the space from which the broken strand was removed, giving it the same twist as the other strands and seeing that it lies smoothly in its groove. Tie the ends of the new strand and the ends of the broken strand in overhand knots by bringing the ends of the broken strand over and under the new strand. Then weave the remainder of the strands into the rope, putting each end over the knot and under the next two strands. Now draw all strands up tight, then weave each end over one strand and under the next a couple of times. After drawing them tight, cut them off close to the rope. Wetting the rope will help to make it draw tighter. This completes the repair, which has neither shortened the rope nor increased its size.

In splicing ropes that are to run over pulleys, it is necessary to make a long, smooth splice so as not to increase the diameter of the

rope or to affect the operation of it while running in pulleys, through eyes, or passing around bends. Such splicing is accomplished by unlaying the strands of the ends of the two ropes to be spliced about 15 turns, tying the ends to prevent raveling, then bringing them together and weaving them into the rope to make the splice. In bringing these ropes together, see that each strand of the right-hand rope passes between two strands of the left-hand rope. Unlay a strand of the right-hand rope about five turns, replacing it with the corresponding strand of the left-hand rope. Keep the strand well twisted to correspond with the strands that have not been unlaid. Now unlay a strand from the left-hand rope, replacing it in the same manner with a strand from the right-hand rope. Repeat this process until all strands have been relaid. Weave the ends of each pair of strands into the rope by passing the strand from the right over the one from the left and under the next one, and taking the strand from the left and passing it over the one from the right and under the next strand. Each loose end is then given two more tucks to complete the tie. Now cut off all loose ends close to the rope. The splice may now be made wet and then rolled under the foot on a floor or plank to smooth it. Such a splice will not have noticeably changed the thickness of the rope, yet it will stand a lot of strain and will work nicely through a pulley.

Farm work frequently requires the use of ropes with a permanent loop at one or both ends. Such a loop can be made by unlaying the strands at the end of the rope five or six turns, then weaving these back into the side of the rope after forming the loop. Bringing the unlaid end of the rope to the left side of the rope at a point that will make a satisfactory loop (working from the left) the center unlaid strand is put under the top strand of the rope and pulled up tight. Holding the loop upright facing you, the right-hand unlaid strand is brought over the strand under which the first strand was placed and underneath the next strand below it. Giving the loop a half turn to the left, the third strand is placed under that strand which lies next to the second strand of the unlaid part of the rope, putting it through from the left side. The ends of the unlaid strands are now taken over the nearest strand and under the next, repeating the process three or four times. This gives one a neat loop, or eye, which is spliced permanently into the rope. Such a splice may be used effectively for permanently fastening a rope to a ring or to a staple.

Facility in making a few simple knots and hitches is helpful in

many kinds of farm work. It is well to know how to tie a knot that will not slip under strain, how to make a hitch that will not work loose. While there are a great many different kinds of knots and hitches in use, a farmer needs to know how to make only a few of the simple ones. These enable him to make efficient ties and hitches adaptable to his needs.

Ordinary knots and hitches are made by combining just three knot elements in different ways. These elements are a bight, a loop, and a round turn, all of which are merely bends in the rope or cord. Different combinations of these elements result in the making of a wide variety of knots and hitches.

Two of the most commonly found in general use are the granny knot and the square knot. The first of these is too commonly used on farms, as it is insecure and will often slip under strain. The latter knot is much to be preferred for general use. It holds well in all cases, except when joining two ropes of unequal size, and it is usually fairly easy to untie. If for no other reason than to avoid using the granny knot, and to make wider use of the square knot, both are described as follows:

To tie the granny knot, take two pieces of rope and cross them at a point a few inches from one end seeing that the right-hand rope is kept nearest you. Hold them before you with the ends protruding upward, right and left. Now take the right-hand end and bring it over and under the other rope. Still holding the two ends upright, bring the right-hand end across the left-hand end, in front, making a complete turn around it. Draw both ends tight. The square knot is made in exactly the same manner except that, in the second movement of the rope ends, the right-hand end crosses the left-hand and, behind, before making the complete turn around it. This knot differs from the granny knot in that the end of each rope crosses the bights on the same side as the rope itself, instead of being separated from its rope by the bight.

The slip knot or running knot is merely a loop in a rope secured by making an overhand knot about the rope above it. It is commonly used to slip a rope up tight around an object, forming a sort of hitch. It is tied by making a loop around a rope with the rope end, then passing the end through this loop from behind, and drawing it up tight.

Another knot of great importance to the farmer is the miller's knot which is used for tying grain bags. It is quickly tied and easily loosened. Gather the open end of the grain bag, holding it between

the thumb and fingers of the right hand. Draw the tie string across the bag with the left hand, passing it beneath the last three fingers and over the first finger of the right hand. Now, with the left hand, bring the string around the gathered part of the bag and beneath the right wrist, being careful to see that it passes over the loose end of the twine and under all the fingers of the right hand. Make another complete turn around the top of the bag in like manner and pull the string up tight. Now use the first finger of the right hand to draw this part of the string up under the part that was placed over the finger in starting the knot. Draw the knot tight by pulling on both ends of the string.

The half hitch is used frequently to fasten a rope temporarily to a timber, pipe, post, ring or the like. It is secure only when the pull upon it is constant. It is made by passing the end of the rope around the timber or pipe, looping it around itself, and passing it back underneath that portion of the rope that starts the loop. The timber hitch is made in exactly the same manner, except that the end of the rope is given one or more twists about itself after making the loop. A very good pipe hitch is made in this manner, using two half hitches and a timber hitch.

Skunk Odor Routs Rats

Condensed from Better Farms

Mariruth Campbell

A SCHOLARLY gentleman with an inquisitive nose has developed a rat repellent, made from the cultured extract from the skunk, that is odorless to the human nose.

Charles W. Sparhawk of the Sparhawk Company, Sparkill, New York, spends a great deal of his life testing, classifying, and creating odors. His rat repellent, called "petra", is but one of the many odors that he creates and uses. His scents are combined in famous perfumes, are used by trappers and hunters for bait, are being tried by fishermen on impregnated lures, and are successful as repellents in pest control.

Speaking of repellents, Mr. Sparhawk says, "Many people are startled by the use of the word 'repellent' in pest control. They understand extermination and

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control but question the possibility of being able to drive rodents out and keep them away with a repellent. But the explanation is simple."

A number of animals—among them dogs, foxes, and rodents—have an extremely keen sense of smell. Scientists claim that it can be as high as 90% more sensitive than man's. Animals use this sense of smell to recognize warnings of danger. It tells them an enemy is near.

So, when Mr. Sparhawk wants a repellent, he finds out what a pest fears and then sets out to create a scent which stimulates that fear and forces the pest to flee.

In the case of rats, he found that skunks (being members of the weasel family) are their natural enemies. Ferrets, hawks, owls, terriers, and cats also keep down the rodent population. Cats, he feels, are better mousers than ratters; and dogs of the terrier type need proper training by exterminators to be effective hunters. Ferrets, hawks, owls, and skunks are not always convenient to keep, especially for the city dweller. But how simple to have a bottle of petra on hand!

The application of petra is easy, simple, and harmless and petra has no toxic dangers. Mixed one ounce to the gallon of solvent, it is sprayed along the lanes where vermin pass—those lanes clearly recognized by dirty marks, brown scratches, and other trails along baseboards, up beams, across rafters.

The vermin pick the mixture up on their warm paws. Since their habit is to clean their feet by rubbing them across their heads and faces, they soon impregnate their fur with the scent of skunk. This smell they carry behind partitions and under floors, places that human hands cannot reach. When they return to their nests they arouse suspicion in their own kind.

When the scent has been picked up by a number of rats, the building becomes permeated with the odor of skunk—still undetectable by the human nose—and the vermin leave and do not return because they know from instinct that their enemy has moved in even though they do not see him.

Applying this same theory—that animals flee what they fear—Mr. Sparhawk has created still other scents that repel. These prove a boon to farmers whose crops are destroyed by rodents, and deer. They are far more efficient than man's first repellent, the scarecrow. And the reason they are so efficient is that Charles Sparhawk "specializes in being disagreeable to animal destroyers of crops, property, and health" and says, "the more repugnant and terrifying we can be, the better we will be pleased."

Profitable Pastures

Condensed from the Guernsey Breeders Journal

E. A. Gannon
Extension Dairyman, Purdue University

UNTIL recently, little thought has been given to the importance and relative value of pasture. Every year, from the beginning of agriculture, as we know it in this country at the present time, there has been some kind of livestock or livestock product, such as steers, horses, calves, hogs, sheep, lambs, and wool, taken off pasture and sold on the market.

With the advent of dairying, pasture is producing a daily crop of milk, a yearly crop of calves, and approximately every three to four years, a crop of cows.

The outstanding requirement in the dairy cow ration is energy. The average dairy cow will graze about six per cent of the immature grass stand on an acre of ground per day. The limit of her capacity is about 150 pounds of green grass, or 30 to 35 pounds of dry matter, depending on her size. A cow will eat enough immature grass, when pasture is at its best, for maintenance and production of well over one pound of butter fat daily.

The average dairy cow will spend only about eight hours of the 24 in actual grazing. The remaining 16 hours should be spent resting and chewing her cud, provided she has had the available feed supply to satisfy her feed requirements. The average dairy cow will consume about two tons of dried pasture grass during the grazing season. This will take from the soil, 115 pounds of nitrogen, 26 pounds of phosphate, 93 pounds of potash, and 37 pounds of calcium oxide, each year. Even with the conservation of the manure, half the nitrogen and phosphate, and 30 per cent of the potash may be lost to the pasture soil.

The milk from one cow giving 8000 pounds of milk yearly removes the equivalent of 80 pounds of 20 per cent super-phosphate, and every 1000-pound animal sold off the farm represents an equivalent loss in terms of super-phosphate.

Pasture improvement is one of the cornerstones in the foundation of the dairy industry.

Data collected by the United States Department of Agriculture in 16 states, show that each 100

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pounds of digestible nutrients obtained from pasture cost 64 cents; from alfalfa hay, 83 cents; from corn, $1.38; corn silage, $1.54, and from oats, $2.02. These are not present-day prices, but the relative differences are about the same.

In seven states, pasture furnishes one-third of the total nutrition at one-seventh of the cost. The cost of producing 1,000 pounds of digestible nutrients, without pasture, was $10.17, while on pasture the cost was $2.01. For every ton of pasture the herd is short a year, one ton of silage, or 700 pounds of hay, or 472 pounds of grain, must be fed to maintain production. Pasture is the cheapest feed that can be grown.

In the selection of a pasture program, the dairy farmer should plan a system that will provide the longest possible supply of nutritious and palatable forage. Individual crops should be rated according to their feeding value, palatability, economy of production, amount and timeliness of yield, length of pasture season, resistance to drouth, weeds and tramping, likelihood of causing bloat or other upsets, and adaptability to soil and climate.

Most permanent pastures are not productive principally because of inadequate fertility and absence of leguminous plants.

Permanent pastures can be much improved (1) by fertilization and renovation, (2) by a system of rotation and controlled grazing, and (3) by reducing the number of weeds by mowing.

Thoroughly disk poor sods and seed legumes such as sweet clover, red clover, lespedeza, or Ladino clover, if no legumes are present. Fertilize with 400 pounds per acre of 0–20–0 where potash is adequate, and 400 to 600 pounds per acre of 0–14–7 where soil and plant tissue tests indicate a deficiency of potash. This treatment will give maximum response only where legumes are already present in the pasture, or if legumes are seeded as mentioned above. Fertilizer may be applied in the fall or early spring. Repeat fertilizer application every two to four years. Lime acid soils with about 1,000 pounds of ground limestone per acre if applied on the surface, or at the rate determined by test if the soil is to be disked. The rate of liming should be reduced when applied to the surface to prevent over-liming of the surface inch or two of soil. Apply manure in the fall or winter at the rate of four to five tons per acre over the entire pasture.

Divide all the permanent pasture into three or four smaller fields, and move the livestock from one field to the next, grazing each field in turn. If available, in-

clude fields of grass-legume mixtures in the system. If possible, arrange the fields so that only one watering place is needed. If the fields contain a good grass-legume mixture, one field may be used as grass silage, or as a hay crop in the spring. If the pasture is to be grazed by beef cattle, one field may be reserved for summer pasture by not grazing it during the spring. Pastures other than Bluegrass should be supplied for dairy cattle and sheep during the summer months.

Where permanent pastures are not available, certain grass-legume mixtures which occur in the rotation system may be used for pasture during most of the grazing season. Such mixtures and other crops may also be used to supplement permanent pastures when they are least productive.

Wheat, rye, winter barley, and winter oats may be used to supply some pasture in early spring, before permanent pastures are ready. Rye is probably the best of the winter cereals for pasture. Winter barley may be used and winter oats in the South.

If no grain crop is to be harvested, the winter cereals will furnish pasture up to the first of June. Rye, if seeded early in the fall, will usually supply some fall pasture. Rye grass may be substituted for the winter cereals where no grain is to be harvested.

Sudan grass is the best emergency summer pasture crop. It may be used when legume seedings have failed, or as a regular summer pasture. Sudan may be seeded after rye which was used for early spring pasture. Seed Sudan at 25 to 30 pounds per acre on soil prepared as for corn. Fertilize with 250 pounds of 0-20-0 per acre. Start pasturing when growth is 12 to 14 inches in height. Graze Sudan with caution during hot, dry periods, or when growth is checked by frost.

Grasses such as timothy, brome grass, and red top, when grown with red clover, alfalfa, alsike clover, or lespedeza, make excellent pastures to supplement more permanent pastures. The mixtures should consist of eight to 10 pounds of legume seed and three to five pounds of timothy or red top per acre, or eight to 10 pounds if the larger seeded grasses are used. Mixtures containing more than one legume and grass are frequently desirable.

Alfalfa should be the dominant legume on fertile, well drained soils, and especially in a long rotation. Use red clover as the main legume in the short rotation, and on soils lower in fertility than those used for alfalfa. Use lespedeza on soils low in fertility, and on lands which should not be cultivated frequently. Alsike clover should be in the mixture if the

soil is poorly drained, or if such spots occur in the field. Sweet clover may be used in the short rotation on soils well limed, and if the entire crop is to be used for pasture.

Use timothy in mixtures for the short rotation, and where the first crop is to be harvested for hay. Brome grass should be used only where the mixture is to remain for three or more years. Brome is most frequently used in mixture with alfalfa as pasture for dairy cattle. Use red top in mixtures with lespedeza.

For best results, the above legumes usually require an application of 300 to 400 pounds of 0-12-12 per acre at the time of seeding; for soils low in potash, an 0-10-20, and for those very deficient in phosphate, an 0-14-7, or 0-20-0 may be substituted for the 0-12-12.

Alternate grazing between two or more fields should be practiced if legumes such as red clover or alfalfa are to be used for pasture during the summer, or throughout the season.

Milk production has been increased from two to five times as much per acre on fertilized permanent pasture, as compared to unfertilized pasture.

Returns for each $1.00 spent for fertilizer will average from $3.00 to $5.00 per acre. Proper pasture management lowers the cost of production; saves grain; will produce larger, stronger dairy cattle; will no doubt add much to their longevity; will prove a potent means of controlling calf losses and herd turnover, and from the standpoint of human health will produce a product of higher nutritional value.

Calves Still Like Old-Fashioned Straw

Calves just don't like new-fangled radiant heating. They'd rather have plain straw bedding; and they do better on it, too.

Dairymen at Washington State College compared radiant heating; raised wooden racks (unheated); and straw. They found that: (1) radiant heating costs twice as much as straw (from calf birth to weaning); and (2) the calves on the rack, and those on radiant heat, have more colds, scours, and infections.

It looks like old-fashioned straw is still the best bet for the calf pen, even if it is hard to get at times.

—Farm Journal

Broiler Profits

Condensed from the Poultry Tribune

G. T. Klein
University of Massachusetts

IF YOU'RE sharp as a broiler grower you can hedge against high feed cost and low selling price—two vicious profit-takers.

Not every brood, but most of them, can make profit dollars for you with this six-point hedging program—(1) High feed efficiency, (2) low mortality, (3) low labor costs, (4) prime quality broilers, (5) reasonable housing costs, and (6) low fuel costs.

This is not a prediction that we're in for a period of unusually favorable times for meat growers. Neither is it a forecast that times ahead look gloomy. It's an analysis of those factors, under the grower's control, that will cut production costs year in and year out.

This is backed by an observation that production of meat birds in Massachusetts and other northeastern states has been profitable for 50 to 75 years. The plan of operation, to be sure, has been changed as the industry advanced. But, fundamentally, these six points have determined profits since the famous "Soft Roaster" days of the South Shore area of Massachusetts.

High Feed Efficiency. Now and perhaps for some months to come, nothing will count quite so much as getting every pound of gain possible out of every bag of feed used. A pound of gain on 12 to 13-week-old broilers from 3.5 pounds of feed is the goal one should shoot at, say Dave Tracht and George Roche, Hampden County, Massachusetts, broiler growers. Their opinions are based on experience in growing millions of birds. They can't make money in tough times on 4.2 pound feed averages for a pound of meat.

Feed efficiency is so important to Tracht and Roche that their men are on a bonus system. Here's the way it works, bonus payments being made when broilers are sold.

1 pound broiler—3.5 pounds feed —regular pay
1 pound broiler—3.4 pounds of food—regular pay plus $50 bonus per man
1 pound broiler—3.3 pounds feed —regular pay plus $100 bonus per man

The plan works. The men are constantly asking, "Do these look

Reprinted by permission from the Poultry Tribune, September 1948, Mt. Morris, Ill.

like bonus birds?" They watch feed wastage; they pull for heavy intake for that gets efficiency. Already these operators have passed out $100 bonus checks in plants where 60,000 were raised.

It is well established that fast growing stock makes most efficient gains. While feed consumption is heaviest with this stock, the pounds of feed for a pound of gain are lowest. Pick for the heaviest birds at 12 weeks and it's seldom that you'll miss picking the most efficient.

And Tracht and Roche find there's feed efficiency in feeding often. After some careful tests they've gone on six feedings a day rather than two or three. The frequent attention to the hoppers attracts birds. A low level of feed in the hoppers reduces waste. Theirs is an alternate feeding program of mash and pellets running something like this—

7 a.m.	9 a.m.	11 a.m.
Mash	Pellets	Mash
1 p.m.	3 p.m.	5 p.m.
Pellets	Mash	Pellets

They admit they may not always give this importance to feed efficiency and frequency. But today's high costs make it first in importance.

And there's a "New Look" in feed that's rapidly sweeping the country. Examine a bag of it and the sack isn't so full. It's heavier for a given bulk. It's higher in energy, running nearly 70 percent corn. It's also high in concentrated vitamins and important minerals. It grows broilers faster —requires less feeds than the old formulas. While costing more per bag, it makes a pound of gain cheaper.

This "New Look" in feed grew out of the investigations of Drs. Harold Scott and Edward Singsen and their co-workers at the University of Connecticut. The Connecticut broiler ration, now known the country over, is the basis for many a new commercial mix. It's growing a first class broiler.

Feed can't be saved with feeders that don't fit the birds. You've got to start on egg flats or the like, switch to an intermediate feeder at a week, and to a large feeder at six weeks.

Broiler growers like to debate whether it's better to feed from bags on carriers or to empty the feed into a bin on the carrier and dip out of the bin with a scoop that fits the feeder. I'll venture my guess that it is a little faster to feed from bags and a coal bucket, but it saves feed through lower wastage to scoop it out of the carrier bin.

Low Mortality. It takes high broiler prices to give a profit when losses run high. A good goal

is not more than 5 to 6 percent loss to 12–13 weeks.

If you should ask broiler grower Raymond Ryder, Hampden County, for specifications for buying chicks and management to bring them through with low mortality, he would probably list these:

1. Buy pullorum clean chicks.
2. Buy chicks from breeders that have had Newcastle.
3. Have sulfa drugs ready for a coccidiosis outbreak.
4. Start all chicks at one time and sell off all of them before bringing in a new lot.

Low Labor Costs. If you can raise the chicks in one building and have a central heating system, carriers, feed on each floor, and running water, one man can care for as many as 20,000.

As you get into six times a day feeding and work for elimination of feed waste, then it takes more labor. At times when feed is particularly high it may be more profitable to have one worker for 15,000 broilers. That is about the minimum if you pay New England wages of $50 to $60 a week. You may have to decide which is most important to save—feed or labor. In the last year it has been feed. The maximum you can afford to pay for labor is about a five-cent piece for the growing of a broiler.

Prime Quality Broilers. When feed, management, and environment have done the best for broilers that's possible, there are still differences traceable to strains and breeding. In general, crosses of Barred Rock males and broiler type New Hampshire females tend to give the most popular birds. This is not the whole story. The strain of Barred Rock males and the strain of New Hampshire females has a great influence.

Broiler quality means a bird that picks cleanly, one with a plump breast, no deformities such as crooked breasts, and a flock that grows fast and uniformly. You can get such birds from a number of breeds and crosses. But no matter what breed or cross you pick, you can buy more intelligently if you know the strains.

Chick price, too, is a factor in profits. It represents about 16 percent of the production cost. But rapid growth, fast feathering, disease freedom are so important in profits that it seldom pays to buy bargain chicks.

Reasonable Housing Costs. A modern brooder house with central heat, running water, feeders, and insulation costs about $1.50 to $2.00 a square foot. This is a high figure. It means that if three broods a year are put through the house, (the house has a life of 20 years, and each chick has one square foot) the broilers will have

to pay about 3 cents each for house rental. It is a higher cost than when brooding in more cheaply constructed or remodeled houses. The higher cost is justified in part by lower fuel cost and greater labor efficiency.

Low Fuel Cost. The lowest fuel cost comes with a central heating system, probably one fired with coal. Oil, which is next on the list, is considered reasonable enough to be practical. Raymond Ryder's figures on a number of broods of broilers figures out to be about 2 or 3 cents a chick for the 12 to 13 week brooding period. This is with a hot water pipe system heated with oil.

The fuel isn't one of the big items in broiler raising, running about 4 percent of the total production cost.

The following table will help you determine which items are most important in the cost of growing broilers. The percentages are approximate and may vary with different growers and circumstances.

Item	*Percent of Total Cost*
Feed	70
Labor	5.4
Fuel	4.3
Chicks	16
Medicine, litter, etc.	3.2
House rental or depreciation	1.1

There are times when it pays to hold meat birds for 4 to 5 pound weights. Though feed requirements for the heavier weights are higher than for 3½ pound broilers, there are markets that pay premium enough to make it profitable. These markets are likely to be just ahead of Jewish holidays, but they may develop at any time of the year when live poultry is in short supply. It is a thin market and can be broken with a small surplus.

Meat raising is likely to go through its ups and downs for many months ahead. There are bound to be times when profits are low. There will almost certainly be rewards for the best growers. You can't control feed prices or selling prices, but you can hedge against them by lowering costs.

More Pork an Acre

Condensed from Capper's Farmer

B. K. Fuller

THE Minnesota Centralized Plan saves pigs, speeds up gains, keeps them healthy, reduces labor. You don't raise 356 pounds of pork an acre by accident. It takes know-how and a system. Ed Sanders, Watonwan county, Minnesota, made that record last year with a system called the Centralized Hog Plan. He has followed it 4 seasons. He made the Minnesota Swine Honor Roll in 1946. With the same plan Sanders' neighbor, Dale Kelsey, raised 8.85 pigs a litter from 28 sows.

H. G. Zavoral, extension swine specialist, University of Minnesota, designed the centralized plan around good hog-growing practices. It especially fits flat country with heavy soils where drainage is a problem and dirt lots are muddy much of the year. Sanitation is a major advantage. But the system also provides permanent, year-round buildings, laborsaving and pasture rotation. It can be adapted, wholly or in part, to an individual farm setup. Zavoral says 200 Minnesota farmers have adopted the plan during the last 2 years.

Foundation of the system is concrete which keeps hogs off contaminated ground. They eat, sleep and drink on concrete. They go from house to pasture on concrete walkways. Pasture is rotated so ground has at least 2 years to free itself of hog-disease germs and parasites. The central house provides clean warm space for farrowing and is a convenient place for castrating, vaccinating, marking and weighing.

Starting the plan from scratch the grower would arrange his hog unit by fitting ground and building together. On many farms it can be set up around the farrowing house by rearranging pasture fences and laying a concrete feeding floor and walkway. The permanent house should have a concrete apron on 3 or 4 sides. Aprons slope and gutters at the edge collect manure.

Hog pasture is divided so each field can be reached with the least amount of concrete walk. Last summer Sanders ran 20 sows and 140 pigs on a 4-acre pasture of brome and alfalfa. He also got a hay crop of 3½ tons off it in the spring. Next year hogs will graze a field in hay this season.

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Sanders lost 40 pigs to necro in 1937. His land is flat and old hog lots were so filled with disease he had to farrow and house pigs on range. That took a lot of labor in hauling water and feed. Hauling is eliminated in the centralized plan.

There is no objection to having hogs come to the house for feed and water, Sanders says. From the farthest corner of the pasture to the house is not over 200 yards. Anyway hogs like to come into the house in the heat of the day. They also spend a lot of time on the concrete apron which is cleaned and flushed frequently.

The concrete walk, running from the house to pasture, keeps hogs off contaminated ground. It is 30 inches wide and 4 inches thick. Fence along both sides keeps hogs from rooting under the walk.

Sanders' record of 356 pounds of pork per tillable acre topped the production of 18 Tilney farms in Minnesota under the management of Edgar Urevig. Quota for the farms is three fourths of a hog marketed from each tillable acre. Sanders sold 211 hogs with a market weight of 67,000 pounds in 1947 from 188 tillable acres. He averaged 7½ marketed hogs a litter.

Eight of the 18 Tilney farms had the centralized system in operation in 1947. Average pork production on these 8 farms was 214 pounds per tillable acre compared with 141 pounds an acre on the other 10 farms. The centralized system works so well it has been installed on 8 more farms this year.

A centralized hog plan is not the complete answer to successful pork production, Urevig admits. Some of his operators without the system beat some of those with it last year. However, he thinks the plan helps make better hog raisers. With it good hog sanitation takes less work.

Close following of the system isn't always possible with fall litters, because the central house is crowded with spring pigs by that time. Sanders and other Watonwan county farmers, therefore, use individual 4-pen houses for fall litters, and pull them up near the central house after frozen ground lessens danger of infection.

Concrete floors and walks do not take the place of other sanitary practices, Urevig stresses. High producers among Tilney farm operators wash sows thoroly before farrowing and clean and disinfect the hoghouse, feed platforms and walkways. Pig management includes vaccination from 3 to 6 weeks and castration at 3 to 4 weeks, not done at the same time, however. Sows and pigs are sprayed for mange and lice with benzene hexachloride. Pigs are wormed with sodium fluoride.

After weaning, pigs get a ration made up of 800 pounds oats, 800 pounds corn, 200 pounds tankage and 200 pounds soybean oil meal. With clean sows, clean houses and clean ground, more pigs are saved. With good legume pasture and a concentrate mixture rich in oats, they make fast gains to catch the early market.

Should We Stop Cultivating?

Condensed from Frontiers of Plant Science

Dr. C. L. W. Swanson
Conn. Agri. Experiment Station

For many years, the farmer's primary purpose in drawing the cultivator over his fields has been weed control. Now, on some crops at least, he can kill weeds by newer, easier methods—chemicals, flame throwers and oil sprays. Where he can get good weed control by such means, should he continue to cultivate?

In the Soils Department at the Connecticut Agricultural Experiment Station we think that one advantage of no cultivation may be an improvement in the way a soil holds itself together—the structure of the soil. Soils with good soil structure are those that are loose, open and porous, with lots of places for air and water to get into the soil easily. Other soils are tight and compact, and have few large air spaces in them. These soils have poor soil structure.

We know that weight and vibration of heavy machines, particularly tractors, pack the soil and help break down soil structure. If we can cut down on cultivation, soil structure should improve, since we won't have to run over the ground so many times with heavy machinery.

Cultivation on light soils also results in the loss of soil organic matter by over-stimulating the soil microorganisms which feed upon it, thus decreasing the supply.

To see whether or not the elimination of cultivation by the use of new methods of weed control will actually benefit soil structure, the Soils Department began a new experiment at the Mount Carmel Farm during the past summer.

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Corn and carrot plots were set up on a Cheshire loam soil. On some plots, weeds were controlled by cultivation; on others, the newer weed control methods were used. 2,4-D[1] and flame control[2] were the new methods used on the corn plots, while carrots were treated with oil sprays.[3] All plots were given equivalent fertilization.

Unusual weather during the growing season gave us unexpected results. In May, we had almost twice as much rain as the average for that month while April and June rains were also well above the normal. In contrast, the months of July and August were unusually dry.

The result was indirect injury to the corn in the 2,4-D plots. The heavy rains that fell packed the ground and, combined with the hot, dry weather that followed, formed a hard crust on the soil surface. This crust did not allow free circulation of air into the soil, and resulted in a decrease in the production of nitrates by soil organisms. The corn showed definite nitrogen deficiency in contrast to the dark green color of the cultivated corn. The flamed corn was also a lighter green in color than the cultivated corn, suggesting less available nitrogen.

These differences did not show up at first. When the corn was 8–10 inches tall, growth of all corn was about the same and all of it had a good green color.

In September, however, the cultivated corn looked much better in all respects than either the flame cultivated or 2,4-D treated plots. Besides being a darker green color, the stalks were thicker and the ears larger and more numerous than on the other plots. The cultivated corn grew vigorously throughout the season and, from visual observation, will produce the largest yield, with the flamed corn next, followed by the 2,4-D treated corn.

Weed control results, though of only secondary interest in this experiment, were interesting. The cultivated plots were practically weed-free throughout the season. For the first month after planting, there were few weeds in the 2,4-D treated plots. A few broad-leafed varieties started coming in with the grass weeds during August. A second application of 2,4-D, 45 days after planting, did an excellent job of killing the broadleaf weeds but the grass weeds were not affected. Flaming kept the weeds down initially but did not kill all of the weeds.

Much less difference in results showed up on the carrot plots. In the early part of the season, the cultivated carrots looked best. They were more vigorous and somewhat larger in size. By Sep-

[1] 1½ pounds sodium salt of 2,4-D per acre, pre-emergence spray.
[2] Also cultivated last cultivation.
[3] 75–80 gallons of oil spray per acre.

tember, however, there was no noticeable difference in size and growth. It was necessary to spot spray the oil-treated plots several times to kill the weeds which came up or were missed. In general, the oil spray controlled the weeds very satisfactorily.

Preliminary measurements of the soil structure on all of the plots have been made. The experiment was planned so that with each cultivation the rear tractor wheel ran over the same ground. Samples were taken in the area travelled by the wheel and from untravelled areas. From the data obtained, it appears that running a tractor over the ground three times during the season has no appreciable destructive effect on the structure of the soil. There is some evidence, however, that previous cultivation and use of heavy machinery has produced a tighter, heavier and more dense soil at the 4 to 6 inch depth than at the 0–2 or 6–8 inch depths.

It is not expected that one year's results will show up the effects of cultivation versus non-cultivation. There is reason to believe, however, that after several years, the cultivated area will have poorer structure than the non-cultivated area. In the Connecticut Valley, soil structure samples were taken this summer at a 0–2 inch depth in a field cropped to potatoes continuously for ten years. The soil was a Hartford fine sandy loam. Samples were taken on the potato row itself, and in the area between the rows travelled by the rear tractor wheel. The soil in the rear-wheel tractor area was 17 per cent heavier than the soil in the potato row. In this field, the tractor was run over the land about a dozen times in the operations of cultivating and spraying the potatoes.

Although we do not have the answer yet on whether cultivation is absolutely necessary, this year's data point up the fact that cultivation is beneficial under certain conditions. At least one such condition is in seasons of abnormally high and hard rainfall. Breaking up the crust left by these rains will aerate the soil, providing oxygen for soil organisms so that nitrates can be produced for the plants.

Judicious combining of newer weed control methods with cultivation, the proportions of each depending upon specific conditions of the season and the field in question, seems to be the best answer. The results should be better soil structure and that means stronger, healthier, and more productive plants.

New Things on Agricultural Lands

Condensed from Soil Conservation

Dr. Hugh Bennett
Chief: Soil Conservation Service

THERE are good reasons to be encouraged about our American land. Not satisfied—encouraged. Here are a few 1948 glimpses at some of the things I saw going on.

First, at mid-August, the corn crop through Ohio, Indiana, Illinois, Iowa, South Dakota, Nebraska, Oklahoma, and Texas was the best looking crop I ever saw. Dark green everywhere except on thinly eroded slopes; uniformly developed and very heavily fruited. On tens of thousands of acres I saw corn that will yield 50 to 100 bushels, plus. It's a record crop that speaks well for the 1948 brand of American agriculture and well-tended land.

Then, too, everywhere I saw the plains the picture was almost uninterruptedly green. South Dakota, for example, was that way from the Black Hills to Iowa, except in the badlands and the yellow stubble of wheat fields. Green grass, green corn—all in violent contrast to the drought-seared landscape and dust-dimmed fields I saw while crossing the State as a member of the Drought Committee in 1936. Instead of ailing land and discouraged people, I saw this year people beaming pridefully over their wonderful yields. Thirty bushels of wheat per acre, forty bushels, even more in some fields, and "more grass than all the animals of the State can eat!" Money in the pocket, too!

I drove over great stretches of "L. U." land, purchased by the Government a decade previously as "submarginal" land. Much or most of this was producing little or nothing when it was bought, and much of it was tax delinquent. One large block had paid no taxes on 76 percent of its extent for more than four consecu five years. The land was eroding when it was bought; much of the rainwater ran away as so much waste, cutting out new gullies and enlarging old ones. There was little grass. People on the land were discouraged.

When the land was bought, improvements were started by the Soil Conservation Service—that is, when the program was turned over to the Service. Fencing, ad-

Reprinted from Soil Conservation, Dec. 1948, Washington, D. C.

justment of livestock numbers to the carrying capacity of the range, delayed grazing, well-dispersed grazing, reseeding. Ponds were built at strategic locations to bring about more even distribution of the grazing. Grazing districts were established, under the direction of local ranchers. Technicians of the Soil Conservation Service made range surveys and conservation land surveys of the purchased areas and. in cooperation with the ranchers, worked out the grazing capacity of the land, area by area.

On a tract of 248,230 acres near Wall, S. Dak.—the Cane Creek District—7,911 animal units were put on the range after the improvement work got well under way for a 7½-month grazing season; now, this year, the same area is carrying 16,821 animal units for the same length of grazing season, and the grass is still improving. Also the erosion is almost completely under control. Not only that, grazing fees are paying the cost of the Government's contribution in the way of technical help, keeping records, etc., as well as the costs of upkeep of the range by the graziers through their grazing districts. Local estimates, moreover, were to the effect that more returns were going into the exchequers of the counties including the grazing lands than the counties had ever received from taxes. Besides this, good payments were being deposited in the Federal Treasury in accordance with the requirements af the Bankhead-Jones Act.

Some of the improvement work in this pasture (if you can call that much land a pasture) consisted of 115 stockwater ponds, 9 springs developed, 33 cattle guards, 209 miles of boundary and cross-fencing, and 19,333 acres seeded to crested wheatgrass. And, altogether, 142 cooperatives were using the grazing land, and paying for it.

Approximately 200,000 acres of South Dakota land that was producing little or nothing a few years ago have been reseeded to grass by the Soil Conservation Service in cooperation with soil conservation districts and grazing districts.

As estimated, on the basis of our surveys and experience with water spreading on some 5,000 acres of land in southwestern South Dakota, there are in the neighborhood of a million acres of range land in the western third of the State on which it is practical to carry on water-spreading operations that will result in doubling the carrying capacity of the land. We drove through some of the land on which water-spreading had given such an increase. It's a promising field of agricultural en-

deavor for South Dakota and other Plains States. You will hear more of this, I am sure.

Stubble-mulch farming is getting along nicely in South Dakota. In some localities pretty nearly all of the grain stubble which we saw plowed had a good mulch of straw and stubble on the surface. In some places we saw about 50 percent clean plowing with no surface mulch and in other places about 85 percent of fair to good stubble-mulching. Use of the practice is growing. Some farmers using the "one-ways" are turning under too much of the crop residue, but ways can be found for improving this.

The idea seems to be spreading that the best time to practice subsurface cultivation for stubble-mulch work is right after the grain is harvested. It is claimed that there is no reduction of yield when the work is done at this time, but usually an increased yield. Stubble-mulch farming is an excellent way to hold both the soil and the rainfall. It will give good protection to a large share of the Plains States' cultivated land.

At Sioux Falls, S. Dak., on August 18, I attended the contour plowing and terracing match, along with 4,000 others. It was an exciting event and of far more importance to people than throwing the discus over at the European Olympics, as I see it.

Two days later, I was at the 2-day plowing match and farm renovation conservation meeting at Cherokee in northwestern Iowa, attended by 43,000 farmers and others.

Nearly a thousand local farmers participated in this meeting in some assigned capacity, I was told, and about a million and a half dollars worth of machinery took part in the work or was on exhibition. Fifteen major measures were applied to the land in the "face lifting" part of the great meeting, not counting the survey and farm plan that were made in advance. I listed these as we drove back and forth over the farm.

These meetings are educating great numbers of people as to the critical need of taking better care of our declining land resource. They are being held in many States, and undoubtedly are doing undeterminable good in the way of education. The importance of this can scarcely be overestimated because the soil is the source of our food, most of our clothing, all of our wood products, and an increasing amount of raw products for industry. It is the most indispensable resource of mankind—the only resource, along with the rains that make land productive, and without which there can be no life on earth.

Yet some individuals are seeing in this movement which was a

hundred years late in getting under way, only enough to say: "Yes, but what is it costing the Government?"

My answer to this negative point of view is: It is not costing the Government a single cent; it is putting more back into the Federal Treasury as the result of the soil conservation now being done than goes out of the Treasury to pay for the Government's technical assistance furnished to the farmers' soil conservation districts. It's an investment, not an expenditure.

The Government does the planning for soil conservation work on these "face lifting" farms and on the millions of other farms in soil conservation districts. Every plan made is done at the request of the farmer-managers of the districts.

During the Cherokee round-up, I stopped off to see the flood control work being carried on under the Little Sioux River Watershed Authorization. Here the Soil Conservation Service is cooperating with the local soil conservation districts in this important phase —the upstream phase—of the flood control job.

The job is being done, subwatershed by subwatershed, beginning at the upper end of the tributary streams, along the "little waters" where floods originate, and working on down to the main channel of the Little Sioux. The procedure is exactly the same in principle as it is in the other watersheds of the country where the Department of Agriculture, through the Soil Conservation Service and the Forest Service, is going extensively into flood control work on watersheds, as authorized by Congress in the 1936 Flood Control Act. The major engineering improvement of rivers for flood control and allied purposes is the responsibility of the Corps of Engineers, Department of the Army. The two Departments work closely together to handle Federal responsibilities for flood control in authorized drainage basins, the activities of one agency supplementing those of the other. This upstream work is an outgrowth of the Upstream-Engineering Conference held in Washington on September 22–23, 1936.

The flood control part of the Service's contribution consists of public-benefit jobs over and above the ordinary soil conservation work carried out, farm by farm,, in soil conservation districts. It covers such items of work as the construction of water-detention reservoirs, gully plugs, diversions, and roadside work of the kind that farmers cannot and should not be expected to do. Farmers ordinarily cannot carry out such operations because of their size and also because they have a public benefit, affecting many people down-

stream from the points of installation. But the farmers are helping, the county highway authorities are helping, the soil conservation districts are assuming responsibility for general maintenance operations and farmer cooperation, and a committee of 12, in the instance of the little Sioux, composed of representatives from the various soil conservation districts covering portions of the watershed, is furnishing very helpful assistance in setting up priority work jobs, assignment and routing of machinery, developing arrangements for farmer and soil conservation district assistance in connection with the cost and execution of maintenance operations, and so on.

Such a highly cooperative arrangement with the farmers is perhaps the backbone of the matter of getting the flood control job done expeditiously and effectively and of maintaining the installations.

The Thebold watershed of 861 acres affords a typical example of the need for detention reservoirs and other water controls along those tributaries of the Little Sioux which traverse the steeper and more difficult parts of the watershed. In this tributary valley, from the upper to the lower end, 3 detention reservoirs; 10 dams, 9 with drop spillways and 1 with chute; 2 road culverts, 1 with chute and 1 with drop inlet; and 2 pipe drop inlets are being installed. The installation of these 17 structures involves approximately 15,800 cubic yards of excavation, 226,400 cubic yards of earth fill, 1,200 cubic yards of reinforced concrete, and 2,000 feet of various kinds of pipe, ranging from 6 inches to 30 inches in diameter. Along the main channel, which has a total fall of 114 feet in about 1¾ miles, a large detention reservoir and 10 small structures will provide for 85½ feet of drop in the water flow (114 feet total, less 28½-foot fall along the channel between the structures). This is the equivalent of reducing the amount of fall in the channel proper to 28½ feet or from a gradient of about 1.3 percent to 0.3 percent. Thus, much of the channel cutting power of the water —85½ feet of drop—will be eliminated by reason of the fact that the energy will be dissipated by dropping on concrete platforms. These 11 structures thus will have the result of reducing the velocity of flow along the earth channel sections sufficiently to prevent serious channel erosion and, coupled with the 6 structures in lateral drainages and the installation of other soil and water conservation measures and proper land use, will practically control the entire erosion problem in the subwatershed.

Looking over the engineering work having to do with the handling of water in this watershed,

one finds rather complicated mathematics translated into the simplest sort of structural devices. The elements of obscurity that normally saturate mathematical equations in so far as most people are concerned are all obliterated. You see at a glance just how the cutting edge of falling water is almost done away with.

In the Nepper watershed, comprising 485 acres, the job of both soil conservation and flood control installation was completed while I was there on August 19, 1948. An interesting item in this watershed is the installation and stabilization of drainage outlets (with grass seedings to protect the banks). In one place where a county road was involved, the county authorities paid for the movement of earth along both sides of the roadbed, amounting to something like $4,000.

The Nepper watershed job was, in point of complexity, a pretty close runner-up to the Cloud Creek watershed of the Washita River flood-control job in Oklahoma. I attended the celebration of the completion of the Cloud Creek job in July, this year. The occasion of that celebration was the completion of the first flood-control job of a tributary flood-stream from upper to lower end as provided for under the cooperative arrangement between the Soil Conservation Service and a soil conservation district. Closely similar jobs have been completed on other watersheds, such as Jones Creek tributary of Soldier Creek, which parallels the Little Sioux. The Jones Creek job was completed by the Soil Conservation Service through the use of a Civilian Conservation Corps camp in 1938. As both a flood-control and erosion-control undertaking, the Jones Creek work has functioned with a high degree of success. It has controlled the erosion almost 100 percent and siltation by nearly 100 percent, and it has reduced flood heights by approximately 75 percent.

This kind of flood-control work, as well as the acre-by-acre complete soil conservation treatment of farms, is something entirely new in America, and probably in the world.

The concept of both is the product of the Soil Conservation Service and its staff. As a matter of fact, both ideas were part and parcel of the original method of procedure adopted by the Soil Conservation Service in its beginning, and adhered to, with refinements, until the present. There are likely to be imitations and short-cuts; but only work based on this sound concept that takes into full consideration the pertinent physical facts can succeed. This is no one's opinion; it's the statement of a law of Nature.

Man-Made Weather Miracle

Condensed from N. J. Farm and Garden

New Jersey farmers could increase their yields greatly with the use of irrigation if they realized that New Jersey doesn't produce nearly enough rain during the growing season to get all there is out of plant growth.

Take that on authority of Dr. C. Warren Thornthwaite, chief weather-maker at Seabrook Farms, Bridgeton, N. J. whose 2,000 acres under irrigation is the largest irrigated project east of the Mississippi.

Dr. Thornthwaite outlined his theory for members of the N. J. Horticultural Society at its annual meeting.

"New Jersey's rainfall is quite uniform," he said, "something like three to four inches a month. But this is on a 12-month basis. During the winter, plant life uses almost no moisture at all, but in July it may require all of six inches. It is not so much how much rain we have, but how much we need, that tells the tale. When we know how much water evaporates from the soil under given conditions, and how much a particular plant will require at every stage of its growth, then we know how much water to apply, and when."

To get some definite information, Dr. Thornthwaite in 1946 brought to Seabrooks a gadget he invented while doing some work in Mexico. It is called an "evapotranspirometer" — "vapo" for short. He has several of these machines which measure accurately the intake and outgo of water in the soil.

In conjunction with his "vapo," Dr. Thornthwaite uses what he calls a "climatological calendar," which takes advantage of such factors as increased temperatures and length of day as the growing season advances. It is based on a detailed study of the growth of various kinds and varieties of plants, day by day.

He found, for instance, that some Alaska peas he planted last summer matured in 39 days instead of the standard 57 promised by the seed company that furnished them. On the other hand, peas of this same variety planted last March 21 were not ready for harvest until June 3, after 75 days of growth. Out went the civil calendar and in came his "climatological" calendar, for he found that the peas

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had grown faster and reached maturity sooner in warm weather than during cool spells.

As a result, Seabrook has been able to level off the peaks and valleys of harvest, even down to the niceties of planting varieties at such split-second intervals that harvesting crews could take nights and Sundays off. Corn, spinach, snaps and limas arrive on schedule, at the peak of maturity and flavor, in easy-to-handle daily quantities for the quick-freezing process.

Dr. Thornthwaite's role extends even farther. There is always the problem of dusting by plane and getting the wrong kind into a neighbor's field. The Seabrook entomologist calls up "Mr. Weathermaker" and asks when to send his planes up, Dr. Thornthwaite studies the atmospheric conditions, temperature, wind, air turbulence—and gives the nod.

"The pilots call me all kinds of names, I guess," he observed, "but sometimes the poorest flying weather is the best for getting dust to settle on the plant."

Dr. Lyman G. Schermerhorn, head of the vegetable crops group at the Experiment Station, observed that Mark Twain once said: "Everybody talks about the weather, but nobody does anything about it."

He obviously didn't include Dr. Thornthwaite!

Sick Soil May Need Boron

Here are some crop ailments that show that your soil needs a shot of borax:

Legumes—leaves turn yellow and plants have what is known as the "yellows."

Sweet potatoes—spaces between joints of the stem are short, leaf stems are curled, and tips of vines are odd-shaped.

Cotton—stalks are short, plants branch more than usual, fruit buds abort, and too many bolls don't mature.

These conditions all show a lack of boron in the soils. Correct by adding borax to your fertilizer.

Alfalfa can use as much as 20 to 40 pounds of borax to the acre. Sweet potatoes and cotton take less, depending on how much fertilizer you use. Check with your State College for the right amount; too much is harmful.

—Farm Journal

What's New in Poultry Nutrition

Condensed from Everybody's Poultry Magazine

Dr. C. E. Lee

WE ARE hearing quite a lot about high energy rations today. A good many poultrymen may wonder just what the difference is between these new "high energy" rations and the rations we have had previously—particularly those before the war.

From a practical standpoint, "high energy" is just another way of saying "low fiber." In other words, poultrymen are being treated to an old principle under a new slogan. No real poultry nutritionist would, within the period of modern knowledge of poultry nutrition, ever advocate the use of a high fiber ration for poultry.

The digestive system of chickens, like that of hogs, is poorly designed to use fiber. Both do best on concentrated feeds. This has been known for years but, after the wartime shortages and the emergency rations poultrymen used from 1942 until early 1947, the old principle may need to be re-emphasized.

Some feed manufacturers have seemed a little slow in getting back to prewar fiber standards. Perhaps they have been impressed by the relative freedom of prolapse experienced with wartime rations which were high in oats and other relatively fibrous feeds. We may need to be reminded of those experiences again. Memories are short and poultrymen seem more inclined than most livestock producers to jump at something new on the assumption that because it is new it must necessarily be better.

Investigators at the University of Connecticut attracted attention to this fiber proposition by bringing out the Connecticut Broiler Ration a couple of years ago. Unquestionably, this has done more than anything else to get people back to producing more normal rations. This Connecticut broiler ration carries an even lower level of fiber than did most rations in prewar days—and certainly lower than was believed most desirable. The elimination of wheat feeds and oats and the inclusion of almost 70 percent corn in the ration did increase the energy value through the elimination of

Reprinted by permission from Everybody's Poultry Magazine, Dec. 1948, Hanover, Penna.

much of the fiber and the addition of a good deal of high fat feed—but it also did some other things.

Since the Connecticut ration was developed, modified but fairly low fiber rations have been put out by nutritionists at the University of Delaware, by investigators at Cornell University, and workers at several other institutions.

Experimental work on low fiber rations has been carried on at colleges and feed research laboratories throughout the world for years. To review all of it would take pages, so we will only look at the conclusions which have been generally made by the research men.

1. High corn content rations do not give as good feathering as do those with wheat feeds and oats.

2. High energy, low fiber rations tend to produce great irritability, feather pulling, and sometimes outright cannibalism, particularly in warm weather.

3. There seems to be an anti-cannibalistic factor, as well as other essential chick growth factors, in oat hulls.

4. Chicks can handle rations with as much as 8 or 9 percent of fiber without harmful effects, either on age of maturity, egg production, or mortality. (We are not recommending feeds with such high levels of fiber, however.)

Young chicks need a relatively high protein and low fiber diet to make the best growth. Unless we are going to sell them for broilers, however, we will be wise if we add grain to the diet after six weeks of age or in some other way reduce the protein and increase the fiber for growing future layers or breeders. If we add grain to the low fiber and high protein mash, we should make sure that the grain mixture includes a generous amount of oats—not less than 20 perecent, and preferably more.

Heuser, at Cornell, has recently reported that adding a vegetable oil to the standard chick starter will give practically the same results as using a low fiber ration. The oil simply raises the energy value per pound. The additional oil in the high corn rations is no doubt partly responsible for their higher energy value, along with the lower fiber intake. The danger of rancidity in rations high in fat is greater, however, particularly in hot weather.

Years ago dairymen tried raising calves on concentrates. The amount of feed used was very small when compared with that fed with a normal calf ration—but so was the digestive capacity of the calf when grown. The little under-developed calves raised on

the concentrated, low-fiber rations weren't worth barn room in the dairy.

We had better give some of these things a lot of thought before we try to raise layers and breeders on diets that are too concentrated. We have to develop the bird first, and you can't do that on an extremely concentrated ration, whether in mash form or as little white pills.

During the past few years we have heard much discussion with regard to the presence of an unknown dietary factor found in certain animal proteins. This has come to be known as the "animal protein factor." It seemed to be required for normal growth and hatchability. Common sources are such animal proteins as fish meal, meat and bone scrap, liver, dried skimmilk, and dried buttermilk. It has also been found in green grass and, surprising as it may seem, in cow manure, even after it has been heated and dried.

The factor has also recently been found in whey solubles, distillers dried solubles, and in hen manure.

The new factor may be the same as factor "X," which has been found highly essential in chick rations.

Many investigators have been trying to synthesize this new factor. It has just now been reported that biochemists connected with a nationally known pharmaceutical laboratory have finally succeeded in producing this material by chemical synthesis. If this material can be produced at low cost, it will be of great importance to the feed industry, particularly in view of the current extremely high price for unextracted liver meals. These meals come mainly from South America, Australia, and New Zealand. They are now selling in this country at around $250 per ton to feed manufacturers, even in lots of several hundred tons.

Fish meal is apparently an excellent source of the animal protein factor, but manufacturers and feed users in the interior of the country cannot obtain fish meal except at high cost and with difficulty. They are in need of a better source of the animal protien factor. The ready availability and low cost of such vegetable protein supplements as soybean oil meal makes them attractive as a source of protein in poultry rations if they can be economically supplemented with the animal protein factor. In this case, the synthetic product might replace meat scrap, fish meal, part of the liver meal, and the dried milk by-products, all of which are expensive.

Feed manufacturers near either coast do not have this problem,

however, since fish meal is readily available. Northeastern poultrymen, for example, have no difficulty obtaining rations with satisfactory levels of fish meal, since all northeastern manufacturers normally have access to an adequate supply.

It has been shown that as little as 3 or 4 percent of fish meal in the ration will supply enough of the animal protein factor, though for other reasons we prefer a much higher level.

Studies to find the best protein level for chick raising have been carried on for years. As early as 1932 it was found that there was a decided increase in efficiency of feed utilization to six weeks of age with rations containing 25 and 30 percent protein over those containing 20 percent protein. Investigations at the Ontario Agricultural College, the Institute of Animal Nutrition, the Oklahoma Experiment Station, the University of California, and other research centers all have borne out the fact that protein levels of 23 to as high as 30 percent gave better results than those ranging from 20 percent on down.

The failure of some investigators to get better results with higher protein levels may well have been due to a deficiency of the animal protein factor. As Dr. Almquist has since pointed out, "The failure of some high protein rations to show any advantage has been due to other growth factors which are deficient."

It has not always been understood that when the growth rate is stepped up, whether by high protein or by other means, it is necessary to considerably raise the levels of a number of vitamins and certain other nutritional factors if growth is to be sustained and the results kept satisfactory in every way. Simply raising the protein of an ordinary ration may not only fail to give a permanent increase in growth rate or feed efficiency but may result in disaster. It takes a well fortified ration to carry the extra protein and to consistently permit the increased rate of growth.

These are only a few of the problems with which nutritionists are working at the present time. Studies now under way and those contemplated will, if past results can be taken as an indication, help poultrymen to continue to increase their efficiency.

Legumes Supply Organic Matter

Condensed from Better Crops with Plant Food

Dr. F. H. Crane
University of Illinois

No MAGIC formula has yet been discovered for maintaining organic matter in soil and at the same time growing cultivated crops, such as corn and beans, every year on the same ground. Yet in the wake of declining organic matter follow surface runoff and floods, erosion, poor tilth, inadequate supplies of plant food, especially of nitrogen, and poor crops. This places the maintenance of organic matter in top place as a soil management problem. It is a problem that is of interest to any and all who are working with soil, whether they are dirt farmers or only have a little patch of ground for flowers or vegetables. And everything that is done to the soil, without exception, affects the organic matter in the soil in one way or another, for better or worse.

There are four questions that may be considered:

1. What is organic matter?
2. What good is it in the soil?
3. Why is it difficult to keep an adequate supply in the soil?
4. What are the special merits of legumes as sources of organic matter?

By organic matter is meant materials built up by plants and animals — straw, leaves, cornstalks, clover, wood, grain, meat. These are organic materials, organic matter. But these things are not *soil* organic matter. They are the materials from which soil organic matter is made. A good everyday term for soil organic matter is *Humus*. From the scientific standpoint perhaps, the term is not very well defined. But it is still a good practical term to distinguish undecayed, unrotted plant and animal products, from this substance in the soil produced by the decay of plant and animal tissues. In other words, cornstalks, straw, clover, etc., are not humus, but humus formers.

Rotting of such materials takes place rather rapidly, in a matter of days or weeks. Soon there is produced in the soil, a dark brown or black, shapeless, more or less slimy material which is called humus.

There is one fact about humus

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which is most essential to any understanding of its effects on soil behavior—that is, that humus is found in the soil mainly as a coating or film around the rock particles, much like a coating of black paint. It clings close to the rock and mineral particles in the soil and is not washed off with water. How thin this coating of humus in the soil is can be judged from the fact that a black clay loam may have only 7 or 8 per cent of humus in it by weight. Yet the 7 or 8 per cent is stretched out to cover up the 92 or 93 per cent of rock particles. Take away the humus and the remainder is very light colored, almost white.

There has been more concern among farmers since the war about the tilth of their soil than was in evidence for 20 years or more before the war. Why this concern or anxiety now? Apparently our soils are getting to the point where they won't stand much further abuse, and where further decline in the amount of organic matter will show up quickly in poor tilth. The last year or two there probably were many examples of poor crops due to poor physical condition of the soil. The plant food was there just the same, but because of the weather, the ground had to be, or was, worked when too wet. Forty years ago the soil might have been able to take such treatment, but with the depleted supply of organic matter today, very poor tilth was the result, and poor yields followed, regardless of the plant food present.

Maintaining organic matter and maintaining good tilth are much more difficult problems than maintaining a supply of lime, phosphate, potassium, etc.

Two of the most important things in soil are clay and humus. Each enters into a multitude of changes taking place in the soil, and humus takes part in more affairs than the clay. It is more affected by farming practice, good or bad. The supply in the soil may be rapidly depleted, or materials may be added which go to form humus, but the amount of clay is practically beyond control. All that can be done is to tame it down, and that is one of the important jobs humus has, to tame the clay.

Clay, by itself, has some very undesirable properties. It is sticky, slippery when wet, and a strong adhesive or glue when dry. These properties are needed to some extent in soils. Sandy soils do not have enough of the clay properties. But in heavier soils, a very important function of humus as a soil conditioner is to tone down these undesirable properties of clay, to give some protection against them.

Humus exists in the soil as a coating around the soil particles. It is especially important as a

coating around the clay particles, and in most soils probably most of the humus is thus associated with the clay. X-rays have shown that clay is made up of extremely fine flakes, much like isinglass or mica which has been divided again and again into thinner and smaller sheets. It takes the X-ray to show this because many of the clay particles are so small that they cannot be seen through the best microscopes.

When clay is wet, there is a film of water between these flakes, which permits the flakes to slide over each other easily yet at the same time holds them together, in the same way that two panes of wet glass will slip over each other easily and still cling together. If a soil is worked when it is too wet, these flake-like particles of clay slide over each other easily and line up in layers, pretty much headed in the same direction lengthwise. The particles are said to be oriented. The condition is comparable to brick laid up in a wall. This is essentially what is found in a puddled soil.

When clay particles are arranged in this way, water will have a hard time finding its way down around and between these tightly packed flakes or particles of clay. When soil in this condition dries out, the particles are tightly cemented together and form a clod.

If there is a good thick coating of humus around these particles of clay, they are kept apart. They do not slide over each other so easily, nor cling together so tightly. Humus swells a lot when wet and shrinks when dry just like gelatin or jello. When a dry soil takes up water, the swelling humus crowds the clay particles apart. When soil dries out, the humus shrinks and the soil begins to break apart. If soil is plowed or otherwise worked when it is in just the right condition, and any good practical farmer knows when that is, these clay particles together with the sand and silt in the soil are rearranged in a loose, open condition. They are not lined up now, but head in all directions like a pile of loose bricks. This is what is called a granular condition—a loose, open arrangement like a ball of popcorn.

It is not just the presence of humus that insures this condition of good tilth. Freezing and thawing, wetting and drying, and lime tend to loosen up a soil and put it in this desirable condition. But it is only when there is a good supply of humus, a good thick layer around the rock particles, that granules are formed which have some degree of permanence or stability, granules which have greater ability to withstand the beating action of the rain, a more lasting crumb structure. So this

condition of good tilth depends on the combined effect of humus and working a soil when it should be worked, not too wet nor too dry. It is the effect of humus in conjunction with freezing and thawing, wetting and drying, and the effect of lime. It is almost or quite impossible to maintain good tilth in most silt loams and clay loams without a good supply of humus.

Important as humus is in helping maintain good tilth in soil, it is important in other ways too. Humus is a storehouse for many plant-food elements. In the first place comes nitrogen. All the nitrogen in soil is stored in the humus. The importance of nitrogen in crop production is well known. It takes nearly as many pounds of nitrogen to produce a crop as of all the other plant-food elements from the soil together. As the humus in a soil declines, along with it goes the nitrogen. From 10 to 75 per cent of the phosphorus in our surface soils is in the organic matter, or humus, as well as a large part of the sulfur, smaller proportions of calcium, magnesium, potassium, and others in forms which plants can use.

No discussion of organic matter in the soil is complete without some reference to its relation to soil microorganisms. Knowing how bacteria and molds thrive and multiply in decaying organic matter, one can appreciate what a wonderful place this film of humus, coating the rock particles, furnishes for the microscopic life in the soil. In fact the whole problem of soil organic matter is one involving the microorganisms in the soil.

A decline in organic matter is almost sure to follow when we cut off the original timber, break the prairie, and start farming land. Probably such a decline has taken place on every farm in the United States. Why is this almost inevitable? Not because crops themselves use up or destroy the organic matter. It is chiefly because the destruction of organic matter is so greatly accelerated when soil is farmed. The very practices necessary to promote crop growth speed up decay and loss of humus. For example, many of the dark-colored soils in Illinois had to be drained before they could be farmed. They were high in organic matter, partly because poor drainage slows up decay and destruction of organic matter. The necessary drainage by removing the surplus water and letting air into the soils speeds up destruction of organic matter. Every time the ground is plowed or cultivated, harrowed or disked, decay of organic matter is further speeded up. For this reason a cultivated crop such as corn is considered to result in about twice as much destruction of or-

ganic matter as a small grain.

So these necessary practices of drainage and tillage of all kinds, together with smaller returns of organic matter to the soil and the laying open of the soil to erosion with consequent loss of the humus-rich surface soil, mean that the amount of organic matter in the soil is almost bound to decline, at least to some extent, when the soil is farmed. For a time this loss may not be serious and certainly not apparent. But finally when perhaps a third of the organic matter has been lost, all at once poor tilth and lower yields seem to be upon us. They have been sneaking up all the time, sometimes masked or hidden behind other improved farming practices, such as use of better seed, fertilizers, and more timely tillage practices with modern machinery.

At the same time it must be pointed out that decay of organic matter although it leads to loss of organic matter, is absolutely essential if we are to realize its benefits in maintaining good tilth and a good supply of available plant food.

The problem of maintaining organic matter in soil is a very different and far more difficult problem than maintaining the supply of lime, phosphorus, and potash. Yet it is linked closely to the supply of those plant foods and even more closely to nitrogen. Organic matter for the soil is not bought in sacks, at least by the farmer. On the farm it is a problem of a good cropping system and good soil management in general.

The first thing to be appreciated about the organic matter problem is this: Very little of the organic materials that are plowed under goes to form humus. Most of the material decays rapidly, leaving in the soil only a relatively small amount of the more permanent form of organic matter—humus.

Work carried on in the greenhouse at the Michigan Experiment Station shows even more strikingly the rate at which the organic matter is lost when plowed under. Quoting Millar and Turk: "With the exception of muck, less than 32 per cent of the added organic matter remained at the end of 2 years, even where 40 tons of dry material per acre were used. In several instances nearly 60 per cent of the added carbon disappeared within 4 months." Where did it all go? Mostly into the air. The work was done in the greenhouse where it was warm the year around, hence decay was more rapid than under field conditions. However, even in the field, soil temperatures are high enough for decay to proceed for more than 4 months every year.

From this it is evident that the

problem is not to be solved by plowing under large amounts of humus-forming materials and then ignoring the problems for the next 10 or 20 years.

There has been a great deal said about the large amount of organic matter produced by some legumes and about their extensive and deep root systems. There is another way in which legumes are superior sources of organic matter, one about which little is heard, but which may be of even greater importance. This is the matter of quality or organic matter, and by that is meant whether it is high or low in nitrogen. That is important in more ways than one, but it will be considered here from the standpoint of humus formation in the soil. The evidence indicates that more humus is produced eventually from material rich in nitrogen than from material with a low content of nitrogen. In other words more humus will be produced in the soil from the rotting of one ton of clover, roots or tops, than from one ton of straw or cornstalks. From this work under laboratory conditions at Iowa, Michigan, and Ohio, it appears that after one or two years from a third more to again as much humus is left in the soil from leguminous materials as from materials such as straw, which are low in nitrogen.

There is further evidence from the field which supports this idea. In field work at various experiment stations, rotations including legumes ordinarily show less depletion of soil organic matter, or in other words more nearly maintain organic matter than rotations without legumes. Note that this is not the same thing as saying that the organic matter content has necessarily increased over what it originally was.

Another thing that should be mentioned is that each year of a legume sod (or a grass sod, too) means one less year in the rotation that the ground is plowed and cultivated during the summer. This is one of the contributing reasons why rotations containing legume hay or pasture help maintain organic matter at a higher level. It is easier on the organic matter in the soil to have one crop of corn in the rotation which yields 100 bushels than to have two corn crops in the rotation which yield only 50 bushels each, since the soil is plowed and cultivated only one season for the single crop.

Decay of organic matter is essential, but at the same time decay results in destruction and loss of organic matter. Farming speeds up the loss of organic matter. Only a small part of organic materials put into the soil remains there as humus a few months later. Since most of what

is added soon disappears, the problem cannot be met by plowing under a large amount at one time and then neglecting the need. The problem calls for the continual, systematic return of all available humus formers. Legumes rate at the top as humus formers. Each year of a sod, legume, or grass means one less year of plowing and cultivation, the practices which so speed up loss of organic matter. No formula has been found for growing corn and soybeans every year on a field and at the same time maintaining organic matter. There is no easy way, nor magic formula, for maintaining or increasing organic matter in soil.

Nitrogen for High-Protein Corn

Condensed from Ohio Farmer

D. F. Beard

YIELDS of grain tell only part of the story. Protein content tells another part. It takes nitrogen to make protein. Nitrogen is found most abundantly in the dark-colored soils rich in humus. Frequent plowing and growing of cultivated crops speed up the decomposition of humus, thereby releasing large amounts of usable nitrogen for crop growth. When soil nitrogen becomes scarce, corn and other non-legumes suffer.

There are just two ways to put nitrogen back into the soil—nitrogen salts in the form of fertilizer or fixation by legumes. Non-legume cover crops and manure help to save nitrogen already produced, but they create none.

Since corn is a non-legume and a greedy consumer of nitrogen, it draws heavily on soil nitrogen. If a large store of this element isn't there, yield suffers and the protein content drops.

Hundreds of feed analyses made years ago gave corn a protein value of 9.3 per cent. In more recent analyses it has contained only an average 8.6 per cent protein. In some parts of the country the average was higher, in others it was lower. Ohio just came up to the average 8.6 per cent. A total of 28 samples gathered from Ohio corn fields in 1948 averaged 8.5 per cent, or nearly the same as those reported from the 1946 crop.

Why the drop from the 9.3 per cent of several years ago? Has the

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turn to hybrids made the difference? Hardly. A difference of 0.3 per cent is the most that can be figured between open-pollinated and hybrid corn. To account for the other 0.5 per cent we must look elsewhere.

For several years Ohio farmers have been experimenting with extra nitrogen on the corn corp. In 1946 a farm in Warren County produced 52.2 bushels of corn to the acre without extra nitrogen and 76.9 bushels with 80 pounds of nitrogen supplied by 400 pounds of sulphate of ammonia to the acre. But that wasn't all of the gain. The protein content in the corn went up with input of nitrogen from 8.15 per cent to 10.7 per cent. Total protein output on an acre rose from 238 pounds to 461 pounds.

This experience has been repeated by many farmers in every part of the state. It proves that extra bushels of corn loaded with extra protein can be produced by putting the necessary raw material, nitrogen, at the disposal of the corn crop.

Will thrifty legume sods furnish enough nitrogen without the use of nitrogen fertilizer? The answer to that question hinges largely on the word "thrifty." In Paulding County, for example, corn following a good mixed legume-grass sod produced 100 bushels of 8.9 per cent protein corn to the acre. In the same field, corn following grass alone produced 50 bushels with 5.9 per cent protein. One other difference should be mentioned. The legume-grass area was pastured and the pure grass cut for hay. The legume had contributed enough nitrogen to the soil to make 50 extra bushels of corn and 333 extra pounds of protein to the acre.

On the good Brookston soil of Putnam County with manure applied to wheat stubble the corn yield was 78 bushels to the acre. Protein content was 7.1 per cent. In the same field where 50 pounds of chemical nitrogen had been applied, the corn yield was 95 bushels and the protein content 8.3 per cent. Sandy soil, often regarded as "poor dirt," with manure and 50 pounds of chemical nitrogen, produced 122 bushels of corn containing 9.1 per cent protein on the same Putnam County farm.

Used with manure, supplemental nitrogen has given very good results. Corn yields were carefully measured from 12 of the fields and estimated on 16 from which protein analyses were made this year. Comparing one field with another is not always reliable. But no matter which way the 28 samples are compared, extra nitrogen on the growing crop resulted in more protein in the harvested grain.

The range in protein contents

from field to field also shows soil exhaustion, or worse. Two fields in which the soil was compact and slow to drain produced corn with a protein content of only 6.6 per cent. One had received chemical nitrogen, but it had little effect on yield and none on protein content. The lowest protein content, 5.9 per cent, came from corn following a nitrogen-starved bromegrass sod. The highest protein content, 10.0 per cent, came from corn following a good Ladino clover green manure crop supplemented with 40 pounds of chemical nitrogen. Highest protein output to the acre was 622 pounds, equal to that of a 30-bushel soybean crop, or a 4-ton crop of alfalfa hay.

To make protein, corn must be given plenty of nitrogen, plus the right kind of soil. Since protein cannot be made without nitrogen, to get high-protein corn put more nitrogen in the land! "High-protein" hybrids can be bred, but they will not make up for lack of nitrogen in the soil.

At least half of the corn fields in Ohio could profit from the use of 50 to 60 pounds of chemical nitrogen each year. This would require a ton of 20 per cent nitrogen fertilizer for each eight acres.

Farm demonstrations have shown that corn on the better land or with good nutrient treatment needs to be planted thicker. The usual 3-per-hill, or 14-inch spacing of seeds in drilled corn, makes too thin a stand. Taking wet and dry, or good and bad seasons as they come, results have averaged out about this way:

10–12 extra bushels of corn for 50 pounds of nitrogen fertilizer to the acre.

10–12 extra bushels of corn for drilling a seed every 10 inches instead of 14 inches.

20–25 extra bushels of corn for extra nitrogen combined with thicker planting.

Here is a simple test that tells whether corn has been planted too thin. Weigh a basket of ears, count them, and figure the average ear weight. If ear weight averages a half-pound the corn was planted at about the proper rate. If the ears average more than 0.5 to 0.6 of a pound each, the stand was too thin for best yield per acre. (Ears between 16 per cent and 20 per cent moisture.) Thin stands that produce big ears do not produce the highest yields of corn to the acre.

Corn yields seldom pass the 100 bushel per acre mark with planting rates that only equal the 13 to 14-inch spacing in drilled corn. A third more plants are needed to do the job.

Lambing Time

Condensed from the Sheep Breeder

Robert M. Jordan
South Dakota State College

LAMBS born and survival are two highly important factors in the determining of profits in raising sheep. A ewe that raises a pair of lambs is about 34% more productive than a ewe that raises only a single, and the ewe with a pair of lambs is about 80% more productive than the ewe that raises no lambs at all. It is pretty obvious that the raising and weaning of a large lamb crop is the difference between profit and loss. The greatest loss comes at lambing time and every effort should be made to save a lamb.

A newcomer in the sheep business often awakes to find that during the night some lambs arrived (dead or alive) and that he has no facilities ready whatsoever. He didn't expect them for another week and realizes, only too late, that the gestation period may vary from about 140 to 155 days. Shrops, Hampshires and crossbreds usually have a gestation period of about 145 days while Merinos and Rambouillets run about 150 days. What he might have done last fall was to paint the brisket of the ram so that the ewes bred early would have been marked. The ewes that are close to lambing will generally have full and distended udders and will, of course, be very heavy in the middle and will start to recede and drop at the tailhead. These ewes should be separated from the flock and the feed reduced. These heavy ewes should be kept in at night so the shepherd can give them close attention. If any of the ewes that you expected to lamb that night did not lamb, they should not be confined to a small pen but should be allowed to exercise so as to keep their systems toned up and reduce any chance of constipation developing. Just shortly before lambing they will refuse feed, generally speaking, and will try to get off by themselves. Have a clean well-lighted and well-ventilated place to lamb and have your lambing pens all set up. These lambing pens can consist of two hurdles, about 4 feet long and 3½ feet high, hinged together at the middle. They should be comparatively warm, 50 to 60 degrees, well-bedded down and free from draughts. Of course, if you are

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lambing on grass, you will be free from most of these troubles. However, if lambing in late April or May on the range, teepees are most handy and are mighty good insurance against spring blizzards. At no other time of the year can an additional man be more profitable on a farm or ranch. At the present prices, it doesn't take too many lambs to pay for a shepherd's wage. Have any and all medication and equipment on hand. Powdered sulfanilamide to arrest infection, epsom salts, castor oil for intestinal disorders and 15% argerol for the lambs' eyes will be of great help.

When you notice the ewe is beginning to labor, put her in a separate lambing pen. After an hour or two, the ewe will generally give birth to a lamb. They are usually born with the front feet and head coming first. Hind legs coming first are also quite normal. If the lamb's nose and front legs are out and the ewe is still having a little difficulty, grab hold of the two front legs and pull down towards the ewe's hocks or feet and the lamb should come quite easily. A little assistance of this nature usually saves the ewe a good deal of straining and she is not so tired and will be able to take care of her lamb sooner. Be sure to remove the mucous from the lamb's nose and vigorous rubbing on the ribs with a slap or two will generally get the lamb breathing in no time. Blowing into the lamb's mouth will also encourage respiration to start. Sometimes things do not run according to Hoyle, and instead of the front feet and head appearing, one hind leg and one front leg, the back or possibly all four feet, may appear or the head may be down or back, or in case of twins, one front leg of each lamb may be presented. At difficult times like these, good sound judgement must be used.

If you must enter the ewe, be sure your fingernails are short and smooth and your hands and arms clean and oiled with mineral oil or white vaseline. Enter the ewe during a lapse in her labor. There is plenty of room in the fore part of the ewe so you don't have to be afraid to push the lamb back so as to make your work easier. It is usually a good practice to tie a stout string or cord on the leg or legs that are being presented so as not to lose them. If it is a case of the front legs coming first with the head down or back or to the side, tie the cord on the front legs, push the lamb back so you have sufficient room to pull the head down or up as the case may be and then gently pull down on the lamb. If four legs are presented, push the lamb back and turn the lamb so you have only two legs coming through the pelvic arch. In extreme cases, it is sometimes helpful to have a helper tip the ewe up on her neck and shoulders.

This will cause the lamb to fall into the cavity and give you more room. It is also very helpful to flush the ewe out with a solution of sulfa and warm water to arrest any infection that may be arising. A book could be written on what or what not to do when lambing troubles arise, but as each case is different, experience will prove to be the best teacher. In the main, be gentle, careful, and think clearly before you act.

Very often after a difficult birth, a ewe will cast her uterus. This can be replaced by first washing the uterus off, disinfecting it and then tipping the ewe up on her neck and shoulders and replacing the uterus back in the body cavity. The use of mineral oil facilitates the replacement and the addition of a solution of warm water and sulfa is very helpful towards prevention of infection. Once in awhile you will run into a ewe that will start to strain and will try to cast her uterus before she has lambed. This is often caused by giving the ewe too heavy a feed, particularly one that is palatable, such as green leafy alfalfa. The ewe is apt to take on too great a fill and irritate the intestines and cause her to commence straining. Smaller amounts of feed and given more often usually eliminates this trouble. If you find that you have a ewe that has cast her uterus after a difficult lambing or is trying to cast her uterus before she has lambed, a simple device may be applied to prevent this. Take 10 or 12 feet of one half inch rope and make a loop in the middle large enough to slip over the ewe's head and down on her neck. Pass the two ends of the rope between the ewe's front legs and then place one end over one side and the other over the other side so that the ropes cross on the top of the ewe. Then pass each end under the rear flanks and out between the hind legs. Tie a series of ordinary granny knots so that the loops they make will cover the vulva. Then securely fasten the ends of the rope to the portion of the rope that is crossed over the ewe's back. When the ewe strains, the pressure will be distributed over her whole body and the loops covering the vulva will prevent her from expelling the uterus. After the irritation or infection has been eliminated and the size of the uterus is once again retracted, the ewe will discontinue straining and the rope may be taken off, though it is generally wise to leave it on a day or two longer just to make sure that all is going well. A Scotchman showed me this trick and for want of a better name we refer to it as the "Scotch hitch."

After you have gotten the young lamb into the world and breathing, make certain that the lamb is able to nurse. If he is too weak, it would be wise to place the end of the ewe's teat in his mouth and

milk a little of the milk into him. Warm milk would help warm the lamb and provide energy. It is almost impossible to get a lamb that is chilled to nurse. If the ewe is a heavy milker, go easy on the feed until the lamb is strong enough to take it all. In fact, she should not be offered any feed until 24 hours after lambing, though water that has had the chill taken off should be offered immediately after lambing, so as to help reduce the fever. Make sure there are no loose bunches of wool hanging down on the under side of the ewe's rear flank or near the udder as a lamb is often apt to get hold of one of these locks of wool and wear himself out and become so weak he will not be able to nurse. Then too, some of them actually pull these locks off the ewe and swallow them which causes intestinal trouble and usually death. The ewe and lamb should remain in this lambing pen for two or three days and should be carefully observed. Be sure the lamb is getting enough milk, though too much milk is just as serious. The first feces that the lamb expells is usually very sticky and often pins the tail of the lamb to the lamb's body. This is called "pinning" and will prevent any further excretion. Pull the tail away from the body and remove this accumulated feces. If you are sure that both the ewe and the lamb are coming along all right, and there has been no trouble with the ewe refusing to own her lamb, they can be removed from their lambing pen and put with four of five other ewes that lambed about the same time. Don't put the ewe back with the band of ewes that has not lambed or with a great big group of ewes, as it is very easy for the lamb and ewe to become separated and the ewe may disown her lamb. Then too, if they are kept in smaller groups for another three or four days, they can be observed more closely. At about 10 days of age, all of the lambs should be docked. This can be done with an ordinary jackknife by cutting the tail off about an inch from the body. A hot iron will also do the job, but the tail will be slower to heal and you are apt to run into trouble with maggots about three or four weeks after docking at which time the scab caused from the burning drops off and leaves an open sore. If the lamb is a ram, he can also be castrated at the same time that he is docked.

Weak, unthrifty lambs are generally either short of milk or have some intestinal disorder. The branding of your ewes and lambs with a paint that will scour out is one of the easiest ways to determine to which ewes the unthrifty lambs belong. You will also find it helpful and very interesting to see how individual lambs develop throughout the summer.

With some of the mutton breeds of sheep, particularly the Shropshire and the Hampshire, one often will run across a difficulty where a lamb's eyelid will have turned under and severe irritation and infection have occurred. If this is caught in time, it is very simple to prevent or alleviate. If the lower lid, for example, is the one that is causing the irritation, pull down the lower lid as you would your own eye in removing a foreign object and pinch together the edge of the lower lid between your thumb and forefinger, thus making a small fold. Hang onto this and slip a string around the base of the projecting lid and tie it very tightly. What you have actually done is taken a tuck in the lamb's eyelid and to say the least, you have taken up some of the slack and excess. Tie this string securely and leave it on. In a few days, the portion of the eyelid that you have tucked will sluff off and the string will break, leaving the lamb's eye perfectly clear. Note the skin has not been pierced nor has a needle been used. A drop of argerol or two will help to clear the eye.

Provide the lambs with a clean dry sunny place in which to romp and play and if you lamb early, provide a crib into which they can go and get good cracked corn and green alfalfa. The cheapest gains are made when the lambs are young, and it is not unusual for a lamb to gain a pound a day. Keen observation is the keynote to successful sheep production. "The eye of the shepherd fattens his lambs."

Pitting Makes More Grass

Pitted pastures carried 36 per cent more sheep than smooth grassland at the Archer, Wyoming, Experiment Station last year. Grassland that was pitted with special disks in 1942 now shows 3 times as much western wheatgrass as the unpitted pasture. More of the taller grasses are desirable because of the variety of feed and earlier spring grazing they provide. Carry-over of grass at the end of the grazing season on pitted pastures, averages 50 per cent more than on the smooth ground, grass specialists at the station report.

—Capper's Farmer

Vermiculite—Magic Substance

Condensed from Seed World

Arthur E. Navlet

Who would ever dream that the featherweight golden nuggets of expanded vermiculite which are "likely to revolutionize building construction"—to quote from an article by Myron M. Stearns in a recent issue of Reader's Digest—are likewise revolutionizing the routine and practices followed for centuries by Horticulturists? Expanded vermiculite is gradually displacing sand as a propagating medium for rooting cuttings; it is a necessary ingredient of a good potting soil compost; it is being used with, and as a substitute for, peat, leafmold and other organic materials in conditioning both heavy and very light soils; its outstanding value as insulation overcomes the shock to plants caused by extremes of high and low temperatures; no better medium has been found in which to store bulbs, especially Dahlia tubers.

Practically worthless in the ore form, this non-metallic mineral, contains well over 1,000,000 laminations or plates of molecular thinness which hold a certain amount of moisture between them. A first-cousin to mica, it weighs about 65 pounds to the cubic foot, and contains traces of other minerals of no horticultural value. Its pH of 7.4 average is of no consequence either, because vermiculite is not soluble in distilled water.

Subjected to 2,000 degrees Fahrenheit, the microscopic water particles, trapped between the laminations of vermiculite, turn to steam and cause a curious expanding motion not dissimilar to the vermicular action of worms and Thomas H. Webb, who discovered this mineral in 1824, named it "vermiculite" because of this. E. N. Alley, discoverer of deposits about 7 miles east of Libby, Montana, named it "feather gold."

The ore, weighing 65 pounds to the cubic foot, is converted by terrific heat to a disease-free, weed-free, sterile, inert, featherweight material which weighs only 6 pounds to the cubic foot. The expanded vermiculite absorbs from three to four times its weight of moisture; traps oxygen vital to the successful propagation of plants; hastens root-

Reprinted by permission from the Seed World, Nov. 21, 1948, Chicago, Illinois

ing materially; encourages development of unusually large masses of roots; doesn't decompose in the soil over a period of time; and supplies a feather-weight substitute for sand which eliminates one of the drudgeries of plant and seed propagation. A 2½ cubic foot bag of horticultural vermiculite weighs about 15 pounds compared to 250 pounds for an equal volume of sand.

Because of the curious nature of horticultural vermiculite, propagators must literally "throw the book away" and experiment on their own to develop the proper technique. The granules of expanded vermiculite are not unlike cork to the "feel", but they can easily be rubbed into powder when dry, or into a greasy substance when wet. Because of its nature, and the fact that the structure can easily be ruined, horticultural vermiculite must never be firmed, compressed or tamped when wet. To do so renders it worthless.

There is no screening, no mussing with leafmold or garden soil and sand in preparation for seeding. One simply pours the horticultural vermiculite as it comes out of the bag into a seed pan, flower pot, box, or seed flat. No discomfort to those who are allergic to dust, no skin irritation from handling it. In fact, it is used as an ingredient in sun tan lotions, when ground extremely fine.

After settling the dry material in the container, thorough watering with a half-strength nutrient solution will supply enough stored moisture and food to carry seedling plants past the "true-leaf" stage. When surface watering becomes necessary, use a rubber bulb to avoid disturbing the surface, or avoid the possibility of encouraging "damping-off" fungus by sub-irrigation. Horticultural vermiculite has an excellent capillary action once thoroughly moistened.

When sowing very small seed such as that of Snapdragons, Lobelia, Schizanthus, Petunias and Primulas, it may be desirable to sift some of the finest portions out of the material to serve as a covering. Normally, one covers the container with a piece of burlap and doesn't bother about covering the seed itself.

Care must be taken not to overwater because in so doing, much of the vital trapped oxygen will be replaced, making it difficult for the plantlet roots to breathe.

Inasmuch as horticultural vermiculite is inert and contains no plant food whatsoever, the necessity for "dibbling off" or transplanting into a soil mixture in which vermiculite replaces sand, is obvious. However, by watering with a nutrient solution, the

plantlets will thrive while awaiting transplanting. Applications of a nutrient solution should always be followed by syringing with plain water to wash food off the leaflets.

There is another method of sowing seed in horticultural vermiculite that is practiced by those who either haven't the time, or are not disposed to transplant seedlings in the true leaf stage. By placing about two inches of a balanced transplanting soil mixture (replace sand with vermiculite) in the bottom of the germinating container, covered with a one half to three-quarters of an inch of horticultural vermiculite on the surface, the seed will germinate readily and the roots of the plantlets reach down into the soil for nourishment. This method makes it possible to delay transplanting, awaiting a convenient opportunity within a reasonable period.

Some of the seed testing laboratories find they can successfully germinate many of the large seeds in vermiculite that are difficult to test under normal laboratory procedure. It is said that when properly used, every viable seed will germinate in this sterile medium.

The rooting of cuttings is equally easy. Some cuttings root better in straight horticultural vermiculite, others do better in a half-and-half mixture with sterilized sand. Camellias, Fuchsias, Coniferous Evergreens, Rhododendrons and other acid plants usually root more quickly and develop better root systems in the half-and-half mixture. Thick cuttings of Geraniums and Pelargoniums also do better in the half-and-half mixture because they are top heavy and the straight vermiculite doesn't offer enough resistance.

Horticultural vermiculite is in a class by itself when used as a summer or winter mulch, worked into the top two inches of soil where the weather is not extreme, and used on top to a thickness of several inches in severe climates. Here again, its value as insulation accounts for the amazing protection given to plant roots under extremes of temperature.

Kansas Good Will

Condensed from Extension Service Review

KANSAS does not face Europe across the sea. Instead, she lies very near the center of a vast continent, with rivers, mountains, and oceans between. Yet she has succeeded in bridging these barriers with the hand of good fellowship to join with war-torn countries of Europe in rebuilding their homes and institutions. A flourishing UNESCO (United Nations Educational, Scientific, and Cultural Organization) has accomplished this, and extension agents have been playing an important role in the organizational and educational aspects of UNESCO.

Home demonstration agents in particular have not only spearheaded the organization of country-wide UNESCO councils but have also been a dynamic force in arousing interest of the 33,687 home demonstration unit members to take some personal part in working toward peace and understanding.

Each of the 1,619 units in Kansas devotes at least one monthly meeting to the study of UNESCO. The June 1948 State assembly of the Kansas Home Demonstration Council unanimously voted to affiliate with the State UNESCO commission.

A large percentage of the county achievement days last fall were built round the UNESCO theme. The Lyon County program was a typical example: "Approximately 350 women attended the afternoon program which was centered on an UNESCO theme. Twenty-eight exhibits by the units included heirlooms and souvenirs from other countries * * *. The program consisted of group singing of foreign songs, a Peruvian dance, talk on China, and a talk on UNESCO. As members of the Associated Country Women of the World, the women contributed to the 'Pennies for Friendship.' "

Homemaker and 4-H camps carried out the UNESCO idea—with campers divided into various countries to study the culture, geography, economics, and government of the country assigned them. Pageants, round-table discussions, exhibits, musicales, special speakers, and UNESCO films —all were media used to tell the story of other lands and other peoples.

Reprinted from Extension Service Review, January 1949, Washington, D. C.

The 12 Kansas homemakers who were delegates to the international meeting of the Associated Country Women of the World in Holland during the fall of 1947 have been particularly active in promoting international friendship and understanding. Most of these women are now a part of the State UNESCO Speakers' bureau.

Besides this educational work, more than 3,000 packages of food and clothing were sent abroad. One group alone sent 1,000 pounds of clothing.

It was a Kansas home demonstration agent, Mrs. Faith C. Stone, then located in Finney County, with headquarters in Garden City, who laid the ground work for the organization of the first county UNESCO council in the United States—in Finney County in June 1947.

Now this council represents more than 100 organizations and is considered one of the most forward-looking in the country. A colorful pageant, "Mother of Peace," put on by Finney County unit members was given recognition at the UNESCO seminar at Lake Success this summer.

Adoption of the town of Zevenbergen, Holland, by Neosho County, Kans., has resulted in a united collection of clothing, food, textiles, and soap.

A fine library of information about Holland has been developed. Schools plan Dutch Days. A shipment of tulips from Zevenbergen will be planted in school yards.

At the present time 38 Kansas counties are organized into councils. Six State colleges have functioning councils. The first to be organized was Kansas State College at Manhattan, whose president, Milton S. Eisenhower, is chairman of the National Commission for UNESCO.

Destroy Those Grubs

Condensed from The Farmer

Dr. F. Gray Butcher
North Dakota Agricultural College

CATTLE grubs are undercover workers, except for that brief period of their lives when as heel flies they annoy cattle. First of the heel flies usually appear in May, and just why they cause cattle to do so much tail-switching, running for shade and brush, and otherwise acting as if the devil himself was after them, no one knows.

Heel flies have no mouth parts, and they don't have stingers. All they do when they dart at the hocks of cattle and cause the cattle to make so much fuss is lay their eggs, about 800 during their very short lives, then buzz off somewhere to die. As most cattlemen in cattle-grub infested areas have observed, the flies are about a half-inch long and resemble a small bumble bee. Examined under a microscope their bodies are found to be covered with hairs, and they are dark in color with narrow bands of yellow or orange.

It is after the heel fly lays her eggs that trouble for the cattle really starts. The eggs hatch within a week's time, and then the tiny grubs crawl down along the animal's hairs, burrow through the skin and disappear. Their journey is a long one. They bore their way through tissue and muscle, getting larger and larger as they go, finally arriving at their destination just under the hide on the backs of the animals.

First move in making their temporary homes on the backs of the cattle is chewing an airhole through the hide. Some hides have one-hundred or more of these air holes. The grubs live under the hide for about a month, and during that time they reach their full growth and become dark colored, about an inch long, with a segmented body, each segment bearing rows of tiny, needle-sharp spines. With these cutting edges on their sides, the grubs finally push their way through the hole in the hide.

After emergence the grub falls to the ground and crawls under the surface of the soil. There it passes through the hardened pupal or resting stage which lasts from three to six weeks. Finally from this form it emerges as a

Reprinted by permission from The Farmer, January 1, 1949, St. Paul, Minn.

heel fly ready to start again with its pestiferous attacks on cattle.

But like most parasites, this one has his period of life when he can be easily killed.

The ideal time to treat is just before the first of the grubs have emerged, but after most of them have reached the animal's backs. To determine that ideal time run your hand over the backs of a few cattle, and if you feel bumps you can be sure they are caused by grubs. About a month after the first of the bumps are found, treat the animals with rotenone, either in dust or spray form, and if the latter, it must be done with a high pressure machine. A second treatment a month later is necessary to get best control.

Although the heel fly doesn't travel more than a half mile away from cattle they will follow cattle much longer distances. This habit will permit heel flies to get to your herd if your neighbor's pasture is nearby. For this reason, grub control efforts will be most effective if the neighbors follow a grub-control program.

Grub control has been well tried in many communities. In North and South Dakota nearly 300,000 head of cattle were treated last winter. Owners of the cattle treated have been enthusiastic regarding the effective results obtained.

A well planned community program will not only improve the livestock in the region, but will also make limited feed supplies go further.

How Much Is This Dairy Bull Worth?

How much is a bull worth in an artificial breeding program?

Sparkling Pilgrim, one of the Jersey bulls in the Louisiana State Breeding Center, cost $1,285. He is a proven bull with an "excellent" rating.

Sparkling Pilgrim's daughters are good milkers. Officials of the breeding center say they produce at least $50 worth more milk per year than daughters of average bulls.

In the first six months of this year, Sparkling Pilgrim artificially bred more than 1,400 cows. They will calve more than 600 daughters that will take their place in the dairy barns 2½ years from now. At $50 increase in milk production for each one, that makes Sparkling Pilgrim's work add up to $30,000 for the six months.

So what is he really worth—the $1,285 he cost, or $60,000 a year?

—Farm Journal

The Beef Steer

Condensed from The American Hereford Journal

Dr. Carl W. Gay
Ohio State University

A FEW years ago when government controls were in force and government planners were considering the diversion of grain from the feeding of livestock to human consumption, the following significant editorial appeared in the Chicago Daily Drovers Journal.

"So much has been said about hogs being more efficient than cattle in the use of feed that it has come to be taken for granted. But not by Prof. A. E. Darlow, of Oklahoma A. & M. It depends on how you figure it, he points out. If you figure it in terms of grain alone, the steer may be handled in such a way that he tops the porker. But let the professor tell his own story:

" 'Comparing the beef steer to the hog, the hog is more economical from the standpoint of the grain consumed, but it is well to remember that an 800-pound steer goes into the feedlot with an absolute minimum of concentrates in him, and that changes the picture materially. Hogs are economical meat producers when grain consumption alone is considered. On a total concentrate basis, beef cattle on bluestem alone or on bluestem and finished with grain are more economical than hogs. . . . By the use of grass, we can trade cotton seed cake for beef, even up, calorie for calorie, and be eating beef instead of cottonseed cake. . . . Folks need to realize that one acre of corn in the Cornbelt will fatten calves that were produced on 30 acres of grass. Also an acre of corn will fatten yearling steers that were produced on 40 to 50 acres of grass. I suggest to you, and I think the figures will prove it, that we can show a greater efficiency in the production of meat if we consider the use of otherwise wasted feed, than can the producer of any other kind of animal food. Within certain limits we can produce beef without reducing the total amount of energy food available for human consumption.' "

The impact of Professor Darlow's conclusion on the thinking of the stockman was, no doubt, something of a shock because it is in conflict with what has been

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so generally accepted as fact. Mr. Darlow's statement is so logical and his deductions so clear that the well-informed livestock operator can hardly take issue if he will think them through.

It is a good thing for us stockmen to get shaken down once in a while. There is a tendency to accept too much for granted. New ideas are not necessarily radical and the fact that they provoke discussion is good for the breadth of our conception of things.

One of the fundamental traditions of our agriculture has been that "corn is king" and most stockmen know that corn got to be king via the hog route, in major part. The hog has become, in the minds of many cartoonists the symbol of American agriculture. By every poll the hog is rated the source of the greatest amount of human food per unit of feed consumed, excepting the dairy cow. Therefore, the idea that the hog has a serious competitor in the steer is, to say the least, novel.

This is no effort to displace the hog from his exalted position in the live stock traditions of this country nor in the live-stock business of the farm. He stands on too firm a foundation. It cannot be done and no one wants to do it. The purpose here is rather to advance the interest in, and give greater recognition to, the part that beef cattle play in our agricultural economy.

This is a timely topic in connection with the federal conservation program. Meadows and pastures are soil-conserving crops, the increased acreage of which is advocated in the conservation plan. It is his capacity to utilize pasture, silage and hay that gives the steer the advantage to which Professor Darlow attributes his supremacy. He also stresses the fact that, within limits, our beef supply may be sustained without interfering with the supply of grain for human consumption.

Both cattle and hogs are fed for three purposes, i.e. to create an outlet or market for farm grown crops, the chief motive of stockmen; to manufacture meat, in a feeding plant, not associated with a farm but where all feed, as well as feeder cattle and hogs, are bought; or to secure the manure to maintain fertility of the soil for the production of some special crop as in the case of the tobacco grower of Lancaster County, Pennsylvania. In this, the greatest cattle-feeding county on the basis of numbers in this country, the cattle are essentially a means to a tobacco end, it being a soil-depleting crop.

The development of the soil-conservation idea in the national farm practice has given greater prominence to grass and forage crops and has done much to ex-

pand their use in live stock production. Promotion of the conservation program affords the steer his inning and he definitely scores over the hog in this respect since the hog's digestive system is not adapted to the use of roughage and he is, therefore, limited in the use he can make of hay and even grass.

Both cattle and hogs are capable of salvaging, for the production of meat, many materials that would otherwise be of little value. Creamery by-products have long been fed to hogs but tankage, wellnigh indispensable to swine growers and used less generally for cattle, was formerly relegated to fertilizer while the mill by-products, currently used extensively as protein supplements and purchased at high prices, were once dumped into the Mississippi River at St. Anthony Falls the site of the big flour mills at Minneapolis.

In the same way, the oil meals, brewer's and distiller's grains, also by-products of the manufacture of starch, breakfast foods and beet sugar, while unavailable for human use, have become valuable constituents of the live-stock ration, particularly that of cattle. Moreover, corn cannot be grown without stover, oats or barley without straw and much land is too rough or dry to be cropped and can be made to yield only by grazing.

In fact, cattle are one of the most important conservation factors in the whole agricultural economy. They make better use of off-grade feeds than any other livestock on the farm. Can you match this with anything but cattle? One bad season the first-cutting alfalfa on the Ohio State University farm was so yellow and stemmy that it was positively rejected by every feeder in the animal husbandry barns. Being of no use it was stacked. When that season's oats were delivered to the animal husbandry department they met with the same reception, too light, dusty and even moldy for livestock to eat. These oats were finally offered to anyone who would take them away but there were no takers. When the corn was sorted that fall there were a lot of nubbins, many of them unsound, for which there seemed to be little use. At threshing time a straw shed was constructed in the barn lot and in late November a set of yearling cattle were weighed into this lot. When weighed out and sold in the spring they had returned $780 on the gains they had made from the worthless alfalfa and oats and the thrownout corn, which was their ration during the winter.

If the primary purpose of feeding livestock is to merchandise farm crops most efficiently, the more completely all parts of all

crops are utilized the better the job is done. While such a thorough feed use of all farm crops is outside the bounds of the hog's productive capacity it is right down the cattle alley.

Every listing of farm animals in the order of the economy with which they convert feed into an edible animal product places the pig second only to the dairy cow and ahead of both cattle and sheep. The hog requires only about half as much feed per 100 pounds of gain as the steer or lamb. Pigs eat more per 100 pounds of body weight and likewise make about double the gains of calves or lambs per 100 pounds of body weight. Pigs not only eat proportionately more but they utilize more completely what they do eat, storing, as an increase in body weight 35 percent of the energy value of their feed while cattle on feed store only 10 percent.

This reads like a strong case for the hog—and so it is—but there is a catch. One hundred pounds of concentrate like shelled corn or even ear corn is much higher in digestible nutrients and net energy than 100 pounds of any roughage. Hays, straws, and stover are "rough" because of their fiber content and fiber is comparatively low in both digestibility and available nutrients. Cattle can make the best possible use of rough feeds because of special provision for breaking down the fibrous roughage in the rumen, thus rendering its nutrient values available. Even the quality of the roughage is of less importance to cattle than to sheep, their only ruminant, meat-making competitors. Sheep are very choicy and pick over hay offered to them, rejecting any but that of good quality.

The writer, as chairman of a department of animal husbandry, was frequently called upon to determine the distribution of a university hay crop much of which was reported by the farm manager to have been considerably damaged by rain and excessive handling. In such cases the low-grade hay was assigned to the beef-cattle barns, not because of any intent to favor the stock in the other barns, dairy cattle, sheep and horses but because of the over-all interest in salvaging the greatest feed value from the damaged hay. Beef cattle would do that.

Not only do cattle enjoy the important economic advantage that comes from deriving so much of their feed from cheaper roughage sources but the cattle feeder has considerable latitude in the extent to which he can capitalize on this function. It happens that over 70 percent of the beef purchased by the consuming public is yielded by cattle of lower than "good" grade. The ambitious,

cattle-proud feeder probably does not realize that less than ½ of 1 percent of all cattle received at the market grade "prime" on the packer's rail and only about 4 percent "choice" in normal market runs. The rank and file of meat customers buy at a price and consequently over half (about 53 percent) of the beef sold is of medium or commercial grade.

Beef grades result both from breeding and feeding. A lack of condition may keep a steer or heifer from making the grade to which it was bred to go, but no amount of skillful feeding can pull a low-bred individual above the grade level to which his breeder consigned him. For these reasons the majority of market cattle do not warrant a liberal use of corn in preparing them for slaughter, but can be made as fat as the market will pay for chiefly on silage, shock corn or even grass alone.

This discussion was prompted by conversation with the manager of some 6,000 acres of good Ohio farm land who markets his crops through livestock. The scope of his livestock operation may be judged from the fact that when lots are full he feeds 1,000 bushels of corn per day. In past seasons he has bred a lot of cows and bought many feeder pigs but during the war he went clear out of the hog business and is now committed to stay out as long as he is operating on the present scale.

His reasons for this decision concerning the hogs are essentially in agreement with those set forth in this article. He eliminates the necessity of hogs following the cattle by using ground ear corn. While his cattle are marketed as dry-lot cattle he makes the broadest use out of pasture, silage and roughage, even resorting to rye or wheat for fall or spring pasture. It takes skillful planning to absorb all the roughage on the acreage cropped but by depending on cattle he gets the job done.

Since the marketing of farm crops is the objective to be achieved in the live-stock-farming operation and all of the farm run of crops are included, such as pasture, silage, corn stover and hay as well as feed grains, the steer is definitely a competitor of the hog in the economic production of meat.

Help in Selecting Feeds

Condensed from Successful Farming

Francis A. Kutish
Iowa State College

	Current price ($ per ton)	Relative feeding value (percentage)	Relative value with corn @ $2.25 per bu. ($ per ton)
Corn ($2.25 per bu.)	$ 80.35	100	$ 80.35
Oats ($1.25 per bu.)	78.13	85	68.30
Wheat ($2.42 per bu.)	80.66	100	80.35
Barley ($1.95 per bu.)	81.26	95	76.33
Rye ($2.25 per bu.)	80.35	95	76.33
Shorts	87.00	100	80.35
Bran	77.00	80	64.28
Tankage	125.00	255	204.89
Soybean meal	94.00	170	136.60
Linseed meal	85.00	170	136.60
Alfalfa hay (loose)	20.00	70	56.25
Clover and timothy (mixed)	16.00	55	44.19

NEW oats, barley, wheat, and rye bring a feeding problem—how to get the most for your feed dollar.

Remember Three Things. Your decision on how much new grain to feed will hinge on three points: First, the price of oats compared with corn, wheat, barley, and the other feeds; second, what kind of feed you have or can buy; and, third, how far you can go from the nutritional standpoint in substituting one feed for another.

The price of different kinds of feeds will vary from one community to another. But the basic feeding value of any feed in a balanced ration is the same everywhere. For example, you can tell if oats is priced out of line by comparing feeding values.

Use Table to Figure Values. The kind of livestock or poultry you have in mind has a lot to do with the value of the feed. But the accompanying table will give you an idea of how the different feeds stack up in general feeding value.

The first column shows the retail price of grains and high-protein feeds in central Iowa when this article was written. Prices today in your community are different. So, you will want to substitute your local prices for those in the first column.

The second column shows the relative feeding value of different feeds, with corn taken as 100. These percentages are based on feeding tests at various state agricultural experiment stations, and on feeding values as shown in Morrison's *Feeds and Feeding*. They assume that other feeds are

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fed in proper combinations, that is, in a balanced ration.

Corn Cheaper Feed Than Oats. You'll see, for instance, that oats is only about 85 percent as valuable as corn for feed. To get the relative feeding value of oats in dollars per ton, we take 85 percent of the current corn price.

The central Iowa price of corn in mid-April was $2.25 per bushel, or $80.35 a ton. So, by multiplying $80.35 by 85 percent, we find the answer to be $68.30 a ton. This means that the price of oats in mid-April could not be higher than $68.30 if this grain were to be as cheap a feed as corn.

Looking at the table, you'll see that this figure, $68.30, has been placed in the third column. This third column shows the relative feeding value, in dollars and cents per ton, of the various grains as compared with corn, when corn is $2.25 per bushel.

Now then, compare this $68.30 with the first column (current price) for oats, and you'll see that it wouldn't have paid to buy oats for feed if corn could have been purchased. In fact, there was a difference of about $10 between the actual market price of oats and its relative feeding value as compared with corn in mid-April.

Of course, this does not mean that you would feed a straight corn ration and not use any oats. But it does mean that, if corn is available and prices are somewhat like the ones used in this example, it wouldn't pay to use more than the minimum amount of oats needed for good nutrition.

Wheat Equal to Corn. Take wheat as another example. When fed in a balanced ration, wheat is fully equal, or even a little better, than corn. So, whichever feed is lower in price is the better feed per dollar invested.

Turning to our table, we see that, with corn at $2.25 a bushel, wheat is worth $80.35 per ton as feed. By comparing the third-column figure ($80.35) with the first-column figure ($80.66), you'll see that wheat in mid-April was almost as cheap a feed as corn.

Protein Feeds Cut Cost. The table also shows that high-protein feeds (oil meals, tankage, or good manufactured balanced supplements) have been an especially good proposition lately. Balanced rations will save a considerable amount of grain when feeding in dry lot or on pasture.

You can use the table also to figure out whether good alfalfa hay or meal is relatively cheap. If so, it will pay you to use a maximum amount of high-quality alfalfa hay or meal in your livestock and poultry rations. Contrary to popular belief, alfalfa meal in pasture hog-supplements actually saves supplement without decreasing gains.

How You Can Switch Feeds. Once you have figured the relative feeding value of the different grains in terms of what corn costs in your community, you are ready to move to the next two steps—availability of other feeds and how far you can go in substituting one feed for another.

Suppose, for instance, that oats turns out to be high priced compared with corn or wheat at your local prices. If you can buy either corn or wheat, the chances are that you will be money ahead to sell oats and buy corn or wheat for feeding.

How to Use Oats. Suppose prices of oats and corn turn out to be about the same. Damon Catron, livestock feeding specialist at Iowa State College, says that if you have enough corn, don't go over 20 to 25 percent of oats in the growing-fattening pig ration.

If oats proves cheaper than corn, and you have only a little corn on hand, you can go up to one-third oats. Catron says it is best to grind the oats and hand-feed it on pasture.

If oats proves very cheap compared with corn, and corn is hard to get, you can go up to 100-percent oats with hogs. If you do, Catron says it is best to grind the oats and slop the hogs. It's the only way to get pigs to eat that much oats. They won't eat enough dry, whole or even ground oats, to make good gains.

If you prefer to self-feed new oats, grind and mix with the protein supplement (about 1,500 pounds of oats and 500 supplement). Be sure the supplement is not straight soybean meal, or the pigs will eat too much.

Elton Johnson, poultry specialist at Iowa State College, says you can feed up to 25 or 30 percent of heavy No. 1 oats in the poultry laying ration. But he warns that it must be heavy oats.

Feeding Wheat, Barley, Rye. You can feed wheat as the entire grain ration for hogs and fattening cattle and sheep. However, cattle and sheep often are thrown "off feed" when fed too much wheat. So, it is best to mix wheat with corn, oats, barley, or bran. Wheat should be coarse-ground for all kinds of livestock except sheep, and coarse-ground or cracked when self-fed to pigs.

Wheat has more protein than corn. This means you will need less protein supplement when feeding wheat as the main grain than with corn.

Barley and rye lie between oats on the one hand and corn and wheat on the other in feeding value. Ground barley makes a satisfactory feed for all classes of livestock. Ground barley is about equal to ground corn for dairy cattle. It is also a top-notch feed for fattening hogs, lambs, and

cattle, altho not quite so good as corn. Barley should always be ground before feeding.

When fed alone or in too large amounts, rye sometimes causes digestive troubles. It is best, therefore, to feed it along with your other grains.

Orchard Mulch

Condensed from Michigan Farmer

Dr. H. B. Tukey
Michigan State College

IT STILL holds that "of the many things a fruit man may do and be wrong in the doing, mulching is least likely to be one." But what is becoming most impressive is that for all the reasons we ascribe to the proper use of mulch, it seems better than we know.

That is, we give the time-worn logical reason why a mulch program is as successful as it seems to be in the orchard, but we still cannot explain all the unexpectedly favorable results that so often occur.

We think we know that when some such coarse material as hay is spread under the tree, usually in sufficient quantities to suppress weed growth, that moisture is conserved, that the physical condition of the soil is improved, that soil nutrients are likely to be more readily available, and that some nutrients are added in the mulch itself. This covers a lot of ground and should probably prepare us for the many responses that are secured. But it doesn't.

One of the most recent reports is from Dr. C. E. Baker of Purdue University. He found a peach orchard which in 1946 was showing the characteristic shortened growth, curled leaves, and reddish margins of trees suffering from potash deficiency. In late 1946 he began a test to correct the trouble, making applications of manure to one area, straw to another, and soybean hay to another. Still another area received an application of 0–0–50 fertilizer, and another section was left untreated as a check. How many tests fail because the check is not included or is unreliable! But in this case everything was in order as it should be.

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By the fall of 1947, the trees that had received 0–0–50 fertilizer no longer showed symptoms of potash deficiency—the trouble was apparently corrected. But that is not all. The trees that had been mulched, whether with manure, straw, or soybean hay also no longer showed deficiencies. The growth was vigorous, the leaves were flat and green, and the potash content of the leaves was markedly higher. On the other hand, the check trees, which received neither mulch nor fertilizer still showed the deficiency symptoms of short growth, curled leaves, and reddish colored margins. The report for 1948 is identical.

Now what does this mean? Now that we know what happened, we can explain the situation easily by saying that there was probably more moisture under the mulch, that the mulch contained some potash which leached into the soil, and that nutrients in the soil were more readily available under the mulch. All of which is probably true. But there are few so bold who would have predicted that mulching would have corrected the potash deficiency.

But this is the kind of thing that mulch users are experiencing. They seem not only to derive the benefits of better water penetration, less water run-off, and general conservation of water, but they seem also to derive some additional benefits that are reflected in just good all around orchard performance.

Of course, there is always the hazard of fire. Anyone who has had the heart-breaking experience of fighting one of those damaging surface fires that can run ever so rapidly through a beautiful orchard will know what is meant. Careless smoking habits have no place in a heavily mulched orchard. Also, mouse damage may be severe unless mice are systematically and scientifically controlled with poison bait or the new, more accurate zinc phosphide treatment. Both of these hazards can be met.

Also, there is the difficulty of securing mulch. To meet this, more and more growers are turning to the practice of growing their own mulch with fertilizer added. Reed's canary grass in a glacial kettle hole, alfalfa on a rough piece, spoiled hay or pea vinery hay from near by—all of these are to be had by the man who works hard enough to get them. And the results seem not only reasonably good, but better than we seem to know.

Shade Trees for the Farm Home

Condensed from Pennsylvania Farmer

O. W. Pflueger

Associate Professor of Forestry, Pennsylvania State College

NOTHING adds so much to the appearance, enjoyment and value of a home as the presence of well shaped trees and ornamental shrubbery.

The mistakes that are made in planting shade trees are easy to make and as easily avoided. The most common ones are the use of the wrong species of trees and planting in a place where the tree will later be in the way.

Before deciding what kind of trees to use, it is well to consider the requirements of an ideal shade tree. No one species of tree possesses all the requirements of a good shade tree, but some trees approach it very closely and selection should be made from these.

Requirements of a Good Shade Tree

1. It should have a good shape with wide-spreading branches.
2. It should carry its branches well above the ground.
3. The crown must not be too dense nor too open; it should allow some sunlight to filter through but not too much.
4. It should be fairly long-lived.
5. It should be fairly free from tree diseases and insect attack.
6. It should be windfirm; with branches not easily broken by wind storms.
7. It should be adapted to the soil in which it is planted and also to the climate of the locality.
8. It should be clean and not litter the ground with its fruit.
9. It must be ornamental and blend well with the general landscape.
10. It should be hardy and vigorous.

What species of trees best fit the above requirements? The following species come close in most respects.

Desirable for Shade

American or white elm.—This is the typical American shade tree and is very desirable due to its beautiful vase-shaped form. Unfortunately in some localities it is susceptible to attack by the Dutch elm disease and Phloem

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Necrosis and, if this takes place, the tree must be removed, as there is no known remedy for these diseases. Therefore do not use elm where these diseases are known to occur.

Pin oak.—While slow-growing, this tree is quite hardy and develops a pyramidal shape. It is especially desirable on small properties, due to its erect habit of growth.

Sugar maple.—An excellent tree, fairly windfirm and of good shape. Relatively free from disease and insect attack. It is more rapid growing than the oaks, but requires plenty of room.

The use of the soft maples, red and silver maple, is not advised. They are easily broken by the wind and are not as long-lived as the sugar maple. They are fairly rapid growers.

Norway maple, a much used, introduced species, is not advised. It makes too dense a shade and kills the grass growing under it. Furthermore, it branches close to the ground and must be pruned in early youth.

Red oak.—Another desirable species of good form. Oaks will grow in much poorer soils than most other species.

Oriental sycamore (Oriental plane tree).—A species much used for street tree planting and also desirable as a shade tree on small properties.

European linden.—This tree has much the same properties as the oriental sycamore. It is fairly free from disease. It needs good soil.

Beech.—Almost the ideal shade tree, but it is hard to transplant. Certain European species, especially the copper beech, are beautiful ornamentals.

Tulip tree or yellow poplar.—A very desirable tree of the Magnolia family. It has beautiful, yellowish-green flowers in May or early June. It is a clean tree and of good form.

Black Walnut.—This tree is desirable where there is plenty of room, as it has a wide-spreading habit of growth. It requires good soil.

Horse chestnut.—An introduced species, fairly common in the eastern United States. Its foliage is somewhat too dense and its fruit litters the ground in the fall.

Undesirable Trees

Some species which have been used in the past have been found undesirable, and should not be planted where permanent trees are desired. Chief of these are the following:

Soft maples (red and silver).—As mentioned above, while quick-growing, they are not windfirm, and when of large size their shape is usually destroyed by heavy wind storms which break off large branches.

Norway maple.—Too dense a shade and branches too low to ground.

Carolina poplar (cottonwood).—A tree much used due to its rapid growth, as quick results can be obtained. It should not be used in the yard as its roots grow very rapidly and clog sewers and cisterns. Furthermore, it is not wind-firm.

Ailanthus (Chinese Tree of Heaven).—This is also a very rapid grower, but its seed is easily disseminated by the wind and it soon becomes a pest. Moreover, it has a very disagreeable odor and does not make a suitable shade.

Catalpa.—Not desirable as it has too open a crown and litters the ground with its fruit. Its leaves are attacked by the catalpa sphinx, a destructive caterpillar.

Sycamore (American plane).—Desirable in many respects, but the leaves are attacked by a fungus which causes them to become spotted and wither.

Some Don'ts When Planting Trees

1. Avoid the use of quick-growing trees such as Carolina poplar.
2. Do not use trees over four years old.
3. Do not use poor stock.
4. Do not plant too close together.
5. Do not plant too close to the house in case it is planned to build an addition.

One of the common mistakes is to place trees too close together. This results in overcrowding when the trees have reached large size. Some will have to be removed to free the others, thus spoiling the effect for which the planting was originally made. It is better to give plenty of space when planting so as to allow the trees to develop properly and assume their characteristic shapes.

The average tree planter is concerned only with present results. He should try to visualize what his planting will look like 40 or 50 years hence when the trees have reached full size. This can be done by visiting some nearby home where the trees have reached large size and noting the distance they are apart, their development as to size and shape, etc. Thus many mistakes may be avoided.

Another mistake is to purchase cheap planting stock. Often trees are brought into a community from nurseries and sold at public sale, or from house to house, at a much lower price than they can be purchased from a nursery catalogue. Trees of this sort are usually culls or seconds and the nursery is taking this means of disposing of stock which could otherwise not be sold and which would be a complete loss. It is better to

buy of a reputable nursery and pay a higher price, as in most cases the stock is first grade and, furthermore, it is guaranteed to grow under proper planting and care.

Do not use stock that is too old, as it is too large for safe transplanting. Transplanting causes a shock to the tree just as an accident does to a human being. Younger stock, not over four years old, will stand transplanting much better. Furthermore it is cheaper than the large sizes and if it dies the cost of replacement is much less.

Just as planting too close is a common mistake, so is planting too close to the building another. There is always the danger of large branches breaking off and injuring the roof, the light and telephone wires, spouting, etc.

Avoid the use of too small a hole when planting a tree. Give the roots plenty of room to develop. If the soil is poor, remove it and use good soil in its place. Dig the hole somewhat larger than the ball of roots. A good rule to follow is to plant so that the root collar is just at or below the surface of the ground. Now, using good soil, place enough in the hole to form a cone on which the tree may rest. The tree is now placed on top of this cone and the remaining soil shoveled in around the roots, tramping it down from time to time to firm the tree. Before planting, any broken and ragged roots should be pruned back to living tissue, cutting straight across with a pruning shears, so that the exposed portion will callous over quickly. If the top is well developed, some of the branches must be cut back to preserve the balance between the roots and crown. Too large a crown will cause the tree to die, as the roots will be unable to supply the larger crown with the necessary food.

When the tree has been planted it is well to water it with sufficient water to enable it to get a good start. A mulch of grass, hay or straw placed around the base of the tree will retain the moisture during periods of dryness. This should be removed in winter to prevent mice from using the mulch as a refuge and barking the tree at the surface of the ground.

Most of the species mentioned above in the list of desirable shade trees will grow well in the central and eastern United States. There are other desirable trees that can be used in the South and the Far West. The catalogues of any large commercial nursery list these trees with their desirable qualities and any of these firms will furnish planting instructions when stock is purchased from them.

Planting may be done either in the spring or the fall; there are advocates of both spring planting

and fall planting. There are certain advantages in each season, but planting may be done at either season with success, provided it is not too late in the spring when growth has already started. Fall planting should be done just before freezing weather has started and when the planting stock is dormant.

Blast-Furnace Slags Have Liming Value

Condensed from Farm and Home Research

Chester E. Evans
Ohio State University

IN ORDER to meet the ever-increasing need for liming materials, the Ohio Agricultural Experiment Station has conducted numerous laboratory and field experiments on the value of various liming materials, among which have been the blast-furnace slags.

There are two types of commercial blast-furnace slags, air-cooled and water-cooled or granulated slag. They differ in the process by which molten slag from the furnace is cooled. This results in different physical textures of the products and has no effect upon their chemical composition. Air-cooled slag is poured into pits in layers, removed by power shovels, then crushed and screened or pulverized. Water-cooled slag is prepared by quenching molten slag by a controlled stream of water, and then pulverizing the material.

Both types of slags are adaptable for agricultural use, and hence both in varying degrees of fineness were compared with a limestone of comparable chemical composition in experimental tests. It was found in field tests using mixed hay as the indicator crop on Wooster silt loam soil that a 2- or 3-ton application of screenings grade (this grade was classified as fine screenings since it contains about three-fourths as much 100-mesh material as is necessary for the minimum requirements of a meal grade) of all liming materials consistently raised hay yields (2 cuttings) from 2.6 to about 3.4 tons per acre.

Screenings of granulated slag were slightly superior to screenings of air-cooled slag and limestone. With the finer grades of liming materials (agricultural meal and ground grades) yields of hay were

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increased. For these grades yields were 3.9, 3.5, and 3.6 tons per acre for granulated slag, air-cooled slag, and limestone, respectively. In general there was little benefit realized from grinding any material finer than the meal grade.

Granulated and air-cooled slags and limestone were fractionated into nine screen sizes varying from 8- to 100-mesh and applied each at four rates to pots containing Wooster silt loam soil. These pots were periodically tested for soil reaction (pH) changes over a period of 18 months. It was found that all materials of 20-mesh or larger had little or no effect upon reducing soil acidity.

It was noted in every case that the efficiency of the material in correcting soil acidity is increased with fineness of liming material. Materials of 100-mesh gave an immediate response in correcting soil acidity. Considering equivalent size fractions, granulated slag was comparable to limestone but better than air-cooled slag in correcting soil acidity. This was true for all rates used.

Both the field and laboratory results emphasize the greater effectiveness of the finer grades of slag and limestone over the coarser materials. Or stated differently, the reactivity of a material is conditioned by specific surface which, in turn, is governed by degree of fineness. For any given size fraction or grade of fineness, granulated slag appears equal to or slightly superior to limestone in correcting soil acidity. Air-cooled slag appears to be slightly less effective. In any case, the materials must be of the agricultural meal grade or finer in order to be most effective.

Hog Profits Grow In Rye and Alfalfa

There's real profit ahead for you if you have some rye pasture for your sows this winter and next spring. The chances are good that your sows will have more and heavier pigs.

But there's something you can do if you don't have the rye pasture. You can increase the alfalfa meal in the sow's ration up to 15% of the concentrate.

In tests at the University of Illinois, gilts on dry-lot weaned less than three pigs apiece. Similar gilts (also on dry-lot), when fed the same ration, but with the alfalfa increased to 15% had nine pigs apiece.

—Farm Journal

The Physical Structure of the Soil

Condensed from Organic Gardening

Dr. Ehrenfried E. Pfeiffer

WE HEAR so much about the elements necessary to the soil, potassium, calcium, magnesium, phosphates, nitrates, manganese and trace elements. We also have learned recently much about soil life and humus forming bacteria, about the work of the earthworm. To observe and maintain all these factors is most important if one wants to have a fertile, living soil. However, it is just as important to have a soil structure upon which the soil life can develop. In a soil with poor drainage, for instance, very few humus-forming bacteria can live and no nitrate fixing bacteria will exist, and the earthworms also get lost.

Recently we had a few soil samples for testing which possessed everything which is needed in ample amounts, all the elements, even trace elements, and still the owners of these soils reported that the crops were not satisfactory. This is usually the case when a soil tends, for some reason, to a crusted surface formation, or when there is a hardpan underneath. This problem is the same in gardens as in farm fields. If one digs a hole in such soils one will usually observe that a top layer of a fraction of an inch can be removed, particularly when it is dry it can be peeled off. Deeper down we find a crumbly soil to a certain depth, maybe two or three inches, maybe even seven inches; then we find the topsoil separated from the subsoil by a change of color. While the surface layer is dark brown the lower layer is yellow brown or bright yellow; the surface soil might be crumbly, but that underneath might be hard. In some cases one observes that this hardpan is almost impenetrable for water and for plant roots. Particularly in old pastures and in old gardens one will observe that the roots look almost as though they had been cut off when they touch this layer. The mineral resources of these layers are not available. Chemically these layers may still be rich. In some cases we have found nitrates and phosphates in higher amounts than in the surface soil but they are not available to the plants. It is, therefore, absolutely necessary to break these layers, to cut through them into the deeper layers which are

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not influenced by our agricultural methods, which can serve as a source of elements. The gardener, particularly the small gardener, usually digs his soil, and works it through to the depth of his spade. The available elements in the surface soil are washed down and filter into the subsoil. This layer where the elements are stored up is not reached. An expensive, but very helpful method, is the so-called trench farming as it is frequently practiced abroad where labor is cheap. The French people, in particular, recommend this method. One digs a trench about two feet deep in such a way that the subsoil is removed separately from the topsoil, then another two foot trench is made next to this one and the subsoil from the previous trench is filled in, then the topsoil, and so one continues until the entire garden bed is dug over. Usually, after this treatment, an improvement in the growth of all kinds of garden crops can be observed. On a farm, of course, this would not be possible and we have to look for other means.

The best way to cut through this hardpan is to use a subsoiler; this is a kind of plough with a sharp blade like a thorn, which is pulled through the soil. A heavy tractor is needed to do this. The harder the hardpan the heavier the tractor has to be. There are several subsoilers on the market, the best known is probably the Killifer, used on large farms, but there are lighter machines, like that of the Windy Subsoil Company and others. There are also subsoil attachments for ploughs, but we have found that in a gravelly subsoil, or where there are rocks or even small stones, this last type will not work so well. It will pop out of the ground as soon as it hits a rock, or it will dig itself so deeply into the ground, that one has to dig it out The cutting principle is the best. One should cut as deep as the soil and the available machinery allow, 18 to 26 or even 32 inches might be good; and the rows, for instance should be three or four feet apart. The results which can be obtained by subsoiling are really remarkable. On our farm we had a field with very poor drainage, because of springs coming from underneath. There was no possibility of putting in drainage tiles, since the field is flat and not enough pitch could be obtained, so we started subsoiling the field. Whereas, in previous years, the field was still too wet by the middle of June to be worked, when we subsoiled it in spring, early in April, we had the satisfaction of finding that the field was dry enough two weeks later to be worked normally and oats could be planted. The oats with clover seeded into it are coming

up nicely. We had been using a Windy Subsoiler to our satisfaction.

Agricultural experts acknowledge the importance of subsoiling but they do not agree as to whether it pays or not, because it is an additional operation and expense. In my long experience in farming I have found that subsoiling pays under all circumstances. In the case of the field mentioned above, it has paid to do it; it has paid not only for the labor involved but has also paid half the price of the subsoiler, because we will have a crop on a field where we could not have a crop last year. Subsoiling is not only a means of improving the drainage system, but whenever a hardpan is formed it is necessary. It will increase the proper structure of the soil and improve the aeration of the soil, and then more soil bacteria and earthworms will live and work there, and thus add to the soil life in general. Malnutrition of the plants which have depleted the surface soil is eliminated to a certain extent by this procedure, because the roots can now grow deeper. If one now digs a hole, and studies the soil profile after a year or two one will observe that the roots reach 3, 4, 5 inches deeper than before, and the roots of deep growing plants, like clover and alfalfa, can now be observed to penetrate to 5 and even 6 feet. The plants now take advantage of the layers where elements are stored. Subsoiling can thus be considered as an important additional means to improve the living soil.

In a small garden it might be difficult to bring about such an effect. But if several people pooled together they might purchase a subsoiler which could rotate amongst them. This would eliminate the expensive deep digging of the trench spading method, as described earlier in the article.

Organic matter does not decompose into humus unless air is present. The aeration of the soil is one thing. Then there is another interesting problem. If the soil contains iron, and lime is supplied, the iron calcium carbonate will be precipitated. This, particularly in a wet soil which is not sufficiently cultivated and in old pastures, forms a layer from ½ inch to several inches thick. This layer is hostile to all plant growth, of grasses, clovers, all cultivated plants, even trees when their roots come in touch with this layer usually stop growing and die off. An interesting observation was made many years ago; a farm was given up and trees were planted on the fields. For about twenty-five years the trees grew very nicely, then they all suddenly started to die. The roots of the trees had by that time reached the second hardpan, after penetrat-

ing the first, thinner layer, and had touched this iron calcium carbonate layer; this spelled the end for these forests. Now it is a fact that almost every field which is under cultivation, particularly ploughed fields, will form hardpans. The sole of the plough furrow itself, especially if the soil is ploughed while wet, will be smeared and sealed off by the bottom of the plough, and then the hardpan gradually forms there. Some people believe that a deeper ploughing will break this hardpan, however, it is just as likely that it will result in the formation of a second and third layer. There is one important thing in ploughing. If you plough the hardpan, you have to set the plough so that the pan is just broken. If you plough too deep you will turn this hardpan on top of the soil surface, and then this will cake together and form a hard crust. The same would be true of the trenching method. Therefore you should set your plough so that you cut into the hardpan and merely break it, not so that it is turned to the top. However, in this way only the upper fraction of the hardpan is cut and the rest is left as it was. This is where the subsoiling comes in, it can be done before other cultivation or after ploughing and disking when the land is level. Old pastures can also be revived by breaking up such hardpan layers. Some soilers are more adapted to use on fields before cultivation, but are not suited to pastures and hayfields because they throw too much earth up to the surface. Be sure that you have one with a sharp blade, mounted vertically, so that the soil is cut and not thrown to the surface, otherwise small ridges will result which will have to be leveled out afterward.

One of the most important rules for cultivating a soil and bringing about a favorable structure, and soil life, is never to touch a soil when it is too wet; if a soil sticks to your shoes it is still too wet. Nor does a soil which is too dry respond well to cultivation, since the lower layers might still be wet and if one mixes the two a lumpy structure results. These lumps are quite a handicap for further cultivation and root crops, such as mangels, carrots and beets, will not grow well in such lumpy soils. You can walk through a garden bed or field of carrots and if you see there underdeveloped plants, you can be almost certain that the seed germinated on top of a lump. Another rule which is frequently overlooked is that with each cultivation you ought to go deeper; first cultivate the top surface, then the surface soil generally, then a little deeper. Then you might go back to the surface because this, as the result of the weight of the machines or your feet, may be caked on the surface.

Then you will have prepared a good seed bed. It is most important for almost all seeds that they are not buried too deep in the ground; 2 inches is about the maximum depth for all seeds. It is usually best just to cover them slightly. To do this you will have to have a fine crumbly structure on the surface. It seems to be best, therefore, to do this subsoiling in the fall, then a good winter drainage will also be brought about. The soil will dry out better and lend itself to a thorough cultivation of the surface.

In planting an orchard or berry patch the ground should be subsoiled before setting out the trees or bushes. With young trees it is still possible to subsoil, but with older trees there is the danger that the roots have gone too far and the subsoiler might harm the roots or not go through at all. In very rocky ground where the subsoiler is not able to cut into the deeper layers, as in Florida for example, a kind of dynamiting can be used. There a dynamite is used which does not blow up holes but just shakes the soil up. I have seen a demonstration of this kind of subsoiling with dynamite in southern France, where the owner of a calcareous hill wanted to plant a garden and an orchard. The soil was rocked by the dynamite and given a shaking and crumbling. Charges were planted at distances of twenty to twenty-five feet and set off all at once. The result was a very crumbly structure of the soil. It was astonishing that the earthworms were not killed but continued to live and multiplied much more rapidly than before. In fact, I observed an extremely active earthworm population in this soil. This is, of course, an exception which is not to be applied everywhere, but only under certain circumstances and supervised by an expert in the field of blasting.

Another problem which we have encountered recently, mainly in California, is that in semi-arid areas, where the surface soil dries out very much but is of a light structure. There we have found more mineral elements, nitrates, phosphates, and potassium in the subsoil than in the topsoil. Through the too-crumbly structure of the topsoil these minerals have been washed down into the substrata by rain or irrigation and are temporarily lost to the plant roots. In such cases two steps are necessary, one is to mulch the surface soil to reduce the washing out and the drying out. The second step is to grow a cover crop or green manuring crop of deep rooting legumes, which can reach those deeper layers with their roots and bring those minerals back to the surface. If these cover crops are then composted or ploughed under as green manures, the surface soil will be enriched.

In this way we have a biological procedure of "a reversing of the soil," not by ploughing but by growth. The fault, which we see in many cases, is that in the surface soils there is too much cultivation, while no attention is paid to the subsoils.

It is wise for every gardner and farmer to orient himself in regard to the physical structure of his soil. Digging a hole about six or eight inches square and as deep as necessary, that is anywhere from one to two feet, will inform him what he has to do. In this way you can even trace in the various strata of the soils what mistakes have been made in previous years. You can tell as far back as three of four years whether there was a wet or a dry year, whether the soil has been ploughed correctly or not, or at the right time or not. When you make the hole, make sharp clean edges, then use a scraping instrument and scrape off the inner wall in order to observe the structure of the soil .

In a garden with heavy clay soil which packs down tightly, you can help by building up raised beds, or by planting the seeds on little mounds or hills. In this way the soil gets more aeration and develops more bacteria, and will become looser gradually also. We have observed excellent results on raised beds and hills with strawberries and tomatoes. Cucumbers and peppers also lend themselves to this practice, and spinach and lettuce too.

Surface Irrigation

Surface irrigation, if frequently repeated, and a lot of water is applied so that the water stands for several hours or days before it is absorbed, also packs the soil down and forms crusts and hardpans. Irrigation which is carefully applied just so that the field is moistened and then stopped and repeated later, after surface cultivation, is much better. Subsoil irrigation would be even better. In greenhouses we have applied this by putting drain tiles about a foot or a foot and a half underneath the surface and filling these with water so that the water gradually seeps out through the porous tile to the soil, and the water is shut off as soon as the surface becomes moist. In this way no hardpans are formed and the crust on the surface will be very slight and can be easily broken up.

Soil Profiles

A chemical analysis will not immediately reveal the influences or hardpans and crusting when the sample is sent to the laboratory since it is usually broken up by the time it gets there although you might find some lumps in it. The digging of a soil profile has to

be done on the spot and the farmer or gardner has to make his own observations. Our neglect of this problem of the proper structure of the soil is revealed when we ask ourselves and one another how many soil profiles we have made and how many hardpans have we found. Very few people are able to answer these questions. It is a most fascinating study I can assure you to dig into each field and look at the structure and then work out the means to improve each. The results will be that more minerals will be available and the plants which grow will grow better and be healthier. In particular, fungous diseases will be lessened and plants will not turn yellow on account of malnutrition. Once done, subsoiling does not need to be frequently repeated. If the farmer has learned to care for the physical structure of his soil properly, he might not need to subsoil more often than once in ten years. On heavy clay soils which pack easily it might be necessary once in five years.

Hardening Plants with Potash

Condensed from Farm Research

Dr. Charles B. Sayre
N. Y. Agricultural Experiment Station

It is well known that nitrogen fertilizers will make plants grow rapidly, and all plant growers make extensive use of nitrogen. While a rapid growth is usually desirable, especially with vegetables, there are circumstances when too rapid growth may result in plants that are too soft and tender, especially if they are to be transplanted. Also, with some crops such as tomatoes an excessive vegetative growth may delay fruit setting. Under such circumstances "hardening" the plants, or checking the soft vegetative growth is desirable.

Moreover, if plants, such as late cabbage plants, are grown in outdoor beds the temperature, and often the water, cannot be regulated. Under such conditions one good way to "harden" plants is to fertilize them with potash. Because of the greater activity of the potash ion in the soil solution this will balance or inhibit somewhat the uptake of nitrogen and pro-

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duce plants with firmer, stiffer stems and higher carbohydrate content that will stand transplanting better.

This was illustrated in some experiments in growing tomato plants at Geneva. These plants were all grown under uniform conditions in the greenhouse and coldframes, using a regular greenhouse composted soil to which was added various ratios of nitrogen phosphorus, and potash. Tomato seedings of uniform size were transplanted to flats containing different ratios of these fertilizers.

Each of these flats received the same amount of nitrogen and phosphorus but varying amounts of potash. The seedlings in the flat receiving no potash were the largest and were very dark green and had made a soft, succulent growth. The seedlings in the flat receiving a complete fertilizer containing 6 per cent potash were shorter and stiffer. The seedlings in the flat which received the same amount of nitrogen and phosphorus plus 12 per cent potash grew stockier and had stiffer stems and the foliage was olive green in color.

When these plants were eight weeks old, at which time they were transplanted to the field, the plants without potash were 16 inches tall, dark green and had green, soft, succulent stems. Those receiving 6 per cent potash in the fertilizer mixture were 16½ inches tall and medium green in color with firm stems with some purple coloring (a sign of hardening) in the stems. The plants receiving 12 per cent potash in the fertilizer were 1 inch shorter with olive green foliage and stiff, firm stems. Expert plant growers who were asked to judge the different lots, rated this lot as the most desirable type for transplanting to the field. Their judgment was verified by the results when these various lots were transplanted to the field. The plants that received the high potash fertilizer required fewer replants and produced a larger crop of early tomatoes.

At the time these tomato plants were in the coldframe an extensive grower of field-grown cabbage plants came to the Experiment Station seeking advice as to how he could salvage several million cabbage plants that he feared would soon become too large and soft for transplanting before his customers would be ready for them. His predicament was this. His plants were growing in an extensive outdoor bed. The early part of the season had been unusually cold and rainy As a result the plants grew very slowly, and he feared the nitrates had been leached from the soil. Consequently he applied a heavy sidedressing of nitrate of soda. Shortly

thereafter the weather became unseasonably warm and his plants grew very rapidly but were making such a soft succulent growth they would not be satisfactory for transplanting.

He was shown the previously mentioned series of tomato plants in the coldframe and noted how the high potash fertilizer was "hardening" the plants. He was much impressed with the firm, stiff stems and stocky plants. He was advised to apply a sidedressing of muriate of potash to his cabbage plants to "harden" them. In order to get a more prompt response, since time was an essential factor, he was advised to apply the potash in solution. Since he was equipped with a large mounted tank with tubes to apply calomel solution to his cabbage plant rows to control cabbage maggot, it was suggested that he use this equipment to apply the muriate of potash in solution directly on his cabbage rows. This was applied at the rate of 10 lbs. of 60% muriate of potash per 50 gallons of water, using 750 gallons per acre.

The result was that very satisfactory plants were produced by this treatment. A few rows were left as an untreated check for comparison. The cabbage plants receiving the potash sidedressing made a stockier growth with firm stiff stems that stood transplanting well, whereas the untreated plants made such a rank soft growth they were discarded.

Similarly, plants in the field, if they are making too soft and rank a vegetative growth, can be hardened by applying potash fertilizer. If too much potash is applied an apparent nitrogen deficiency may occur.

Copper Speeds Pig Gains

Four ounces of copper added to each ton of feed speeded pig gains on concrete 10 to 15 per cent in tests made by L. E. Carpenter, University of Minnesota scientist, working at the Hormel Institute at Austin. Carpenter conducted 2 trials. In the first, 70-pound pigs gained 92 pounds in 11 weeks when no copper was fed. Those that got copper gained 111 pounds. In the second test pigs that got no copper made average gains of 118½ pounds in 18 weeks while those receiving the copper gained 131 pounds.

The ration fed in both cases consisted of a mixture of 41 pounds ground corn, 20 ground oats, 10 middlings, 7 soybean meal, 5 meat scrap, 5 tankage, 10 dehydrated alfalfa meal, 2 of simple mineral.

—Capper's Farmer

Churches That Farm

Condensed from the Farm Journal

IF YOUR church has trouble raising money to do all the things it should (and what church doesn't?), here are two congregations with an idea.

They are Green Valley Chapel near Mt. Vernon, Ohio, and Pleasant Dale Church of the Brethern near Berne, Ind.

Members knew that their churches were failing, financially and otherwise. Both groups solved the problem the same way. They got some land and *put their churches into the business of farming*. One bought a farm, the other rented one.

In most churches members pledge money to pay the minister. But in Green Valley Chapel and Pleasant Dale, they also pledge time and machinery to work the church farm.

Just two years ago Green Valley Chapel was on a circuit with three other churches. Members saw their pastor once every two weeks as he shuttled between communities. Interest was slipping.

Then church officers called a meeting. They agreed that Green Valley needed a full-time minister —a man who could live with them and share their problems. But there was no place for him to live, and many doubted if Green Valley alone could pay him.

But finally out of more meetings and long talks, came a plan. The members formed the Green Valley Community Christian Association, and raised $8,600.

They used $7,000 of it to buy a 78-acre farm near by. That left only $1,600 to remodel the farm house as a parsonage. It wasn't enough. They borrowed $900 more, but this is now paid off, too.

Green Valley's crops have done well. The wheat went 20 bushels an acre this year, and the corn about 50 bushels. "We'll better those yields," says Art Coffing, farm manager (without salary), who sends word to members when help is needed on the farm.

Reverend Stewart is paid a fixed salary, but also gets free feed and stabling for his livestock—two milk cows, some sheep, and a litter of pigs. He and Mrs. Stewart raise a good garden.

So far income from the farm has been used mainly to improve the farm buildings, tile waterways in the fields, and in extra fertilizer to build up production. But in another year, members expect the farm to put a healthy bulge in the church's bank account.

Now let's visit Pleasant Dale.

Reprinted by permission from the Farm Journal, Jan. 1949, Philadelphia, Penna.

Four years ago the Rev. Russell Weller decided that there was nothing wrong at Pleasant Dale that more money in the church balance wouldn't cure. But how to get that money?

He pondered the problem, and finally mentioned one of his ideas to the men of the church. Mrs. John Yaney, a minister's widow, owned an 80-acre farm near by. Why not see if she would rent it to the church on a 50–50 crop-share basis?

Mrs. Yaney liked the idea, and soon tractors, plows, and grain drills were busy in the fields. That fall the oats went 60 bushels an acre, the corn 75, and the soybeans 25. When the crops were sold, the church paid Mrs. Yaney $2,300, and had an equal amount for its Christian program.

Reverend Weller keeps an eye on the fields, and notifies members when work is needed.

Both Green Valley and Pleasant Dale folks have found that working and planning together boosted community fellowship—just an added dividend besides solving the financial problem.

So, if your church isn't clicking, perhaps you need to tie it to the land. Green Valley and Pleasant Dale folks know it works.

Mulching Will Help Save Orchard Soils

Fruit growers over the country are turning more and more to mulching as a way of handling orchard soils.

It's pushing out the age-old practice of clean cultivation, and is even giving cultivation with cover cropping some keen competition.

Reports from Ohio and other areas show that mulching makes all plant food elements more available to the trees.

In addition, mulching helps prevent soil washing. Although it has been used mainly in apple orchards, it can also be used for other tree fruits, even peaches.

What is used for mulch varies in different parts of the country, depending upon what is available. Hay, swamp swale, straw, and seaweed have all been used successfully.

Recent tests in New Hampshire showed that a hay mulch kept down weeds and grass and increased soil fertility. Sawdust was also tried, but was not as successful as hay.

Tests in Massachusetts also have shown that plant food additions were rarely needed when a heavy hay mulch is used.

Many growers use low, early-frosted or wet-ground not adapted to orcharding as a place to grow mulching materials.

—Farm Journal

INDEX

BEEF CATTLE

Appraising the Pedigree ..... Oct., 1948
Cattle Feeding Gate cuts Costs ..... Oct., 1948
Meat on the Lifeline ..... Oct., 1948
Careful Marketing cuts Meat Costs ..... Oct., 1948
Science helps Livestock ..... Oct., 1948
Unreckoned Profits from Feedlot ..... Nov., 1948
Blueprint for Beginners ..... Nov., 1948
The Quest for Tenderness in Beef ..... Dec., 1948
The Common Liver Fluke ..... Dec., 1948
More Beef from Grass and Hay ..... Jan., 1949
Shipping Fever ..... Feb., 1949
Steer Feeding Experiment ..... Feb., 1949
Bright Future for Beef Breeding ..... Feb., 1949

CONSERVATION

Calming the Waters of the Coosa ..... July, 1948
Water Whenever You Need It ..... July, 1948
New Lease "Rider" ..... Aug.-Sept., 1948
Water Put to Work ..... Aug.-Sept., 1948
So You Have No Erosion ..... Nov., 1948
Birth of a New Farm ..... Nov., 1948
America's New Acres ..... Nov., 1948
Why be a Friend of the Land? ..... Jan., 1949
Vermont's Sandblows ..... Jan., 1949
*Is Soil Conservation Worthwhile? ..... Feb., 1949
A Living Rose Fence ..... Feb., 1949

CROPS

Corn 50 Years from Now? ..... July, 1948
Careful Cultivation Means More Crops*, ... Aug.-Sept., 1948
Harvesting Forage Crops ..... Aug.-Sept., 1948
A Rotation Worth a Fortune ..... Aug.-Sept., 1948
Can You Tell When Crops Need Feeding? ..... Aug.-Sept., 1948
Corn Borer Parasites Established ..... Oct., 1948
Better Protein, More Oil in Corn ..... Oct., 1948
*Get Corn Rootworms Chemically ..... Oct., 1948
*Weedless First Cutting of Alfalfa ..... Oct., 1948
*Turn Atomic Energy on Corn ..... Oct., 1948
Birdsfoot Trefoil ..... Dec., 1948
Kentucky's Wonder Grass ..... Dec., 1948
You could have more Corn ..... Dec., 1948
Sudan Grass ..... Dec., 1948
*Are Soys hard on Soil? ..... Dec., 1948
*New Royal Wheat ..... Jan., 1949
Seed Certification ..... Jan., 1949
Hard Seeds in Legumes ..... Jan., 1949
Conditions Affecting Crops ..... Feb., 1949
*Stubble Mulch ..... Feb., 1949
*Wheat ..... Feb., 1949

DAIRY CATTLE

Minimum Grain Rations ..... Mar., 1948
Shy Breeding Can be Inherited ..... Apr., 1948
Milk-Borne Diseases ..... Apr., 1948
20 Cows—200,000 Pounds of Milk ..... May, 1948
Reducing the Cost of Production ..... May, 1948
Weather influences Calf Health ..... May, 1948
*Milk before Freshening ..... May, 1948
*Calves Make Better Use of Grain ..... May, 1948
When is a Cow Contended? ..... June, 1948
Cattle get TB from People ..... June, 1948
*Save the Colostrum ..... July, 1948
Develop Your Dairy Heifers ..... July, 1948
Dairy Herd Turnover—Is Vitamin D a Factor? ..... July, 1948
Facts in Herd Management ..... July, 1948
Don't Blame the Bull ..... Aug.-Sept., 1948
Dairy Ctatle Breeding Experiments, ... Aug.-Sept., 1948
The Dairy Sciences in Great Britain, ... Aug.-Sept. 1948
Low Cost Production ..... Oct., 1948
Breeding High Testing Cows ..... Nov., 1948
Factors Affecting Fertility ..... Nov., 1948
Aspects of Milk Hygiene ..... Nov., 1948
Milk Production in Pen Barns ..... Dec., 1948
Trace, Minerals Nutrition ..... Dec., 1948
Buying a Dairy Cow? ..... Dec., 1948
Why Do Cows Bloat? ..... Jan., 1949
Keeping Old Bulls in Service ..... Jan., 1949
Cooperative Milking Barns ..... Jan., 1949

FARM ECONOMICS

Reducing Chore Labor ..... June, 1948
The World Farms for Food ..... Aug.-Sept., 1948
How Poor can a Farm Get ..... Oct., 1948
Farm benefits from a good Lease ..... Dec., 1948
On the Spot Farm Research ..... Feb., 1949
Planning Committees ..... Feb., 1949

FARM BUILDINGS

Farm-Building Management ..... Jan., 1949
A Barn That Saves Labor ..... Feb., 1949
A Fence for the Future ..... Feb., 1949
Dairy Pen Barns? ..... Feb., 1949

FARM MACHINERY

How to Choose a Haying Method ..... Oct., 1947
New Machines on the Farm Horizon ..... Oct., 1947
Research Begins on the Farm ..... Nov., 1947
Hay Crusher ..... Dec., 1947
Self-Feed Hay Dryer ..... Jan., 1948
Hay Finishers Prove Their Value ..... Jan., 1948
What Makes Machinery Wear Out? ..... Feb., 1948
Silage Comes Tumbling Down ..... Feb., 1948
Field Forage Harvester ..... Mar., 1948
Milking Through a Pipe ..... Apr., 1948
Farm Mechanization ..... Dec., 1948
*Cleans Barn every 7 minutes ..... Dec., 1948
Electric Litter Stirrer ..... Feb., 1949

FEEDS

Prime Feed at Low Cost ..... Oct., 1948
Feed those Cobs ..... Dec., 1948

FERTILIZERS

Fertilizer Nitrogen from Various Sources, ... Mar., 1947
There's Money in Manure ..... May, 1947
Feed the Crops for High Yield ..... Apr., 1947
The Story of Fertilizer ..... July, 1947
Ca vs. Mg in Agricultural Lime ..... July, 1947
The Fertilizer Rate Problem ..... Aug.-Sept., 1947
How to Build Lasting Fertility ..... Mar., 1948
Stretch Your Fertilizer Dollar ..... Apr., 1948
The Story of Nitrogen Fertilizer ..... Oct., 1948
Nitrogen helps Winter Wheat ..... Dec., 1948
*Noncaking Fertilizer ..... Jan., 1949
Buy Lime by Quality ..... Jan., 1949
Are You Wasting Fertilizer? ..... Feb., 1949
Phosphates from Ancient Animals ..... Feb., 1949

FORESTRY

Power Pruning ..... Mar., 1948
How to Heat with Wood ..... June, 1948
Fence Posts from Soft Woods ..... June, 1948
Sweet Gum from the Sweetgum ..... July, 1948

INDEX

What about Windbreaks ..... Oct., 1948
Spray Stumps at any Time ..... Dec., 1948
Woodland Co-op ..... Feb., 1949

FRUIT

Benefits of Orchard Mulching ..... Mar., 1948
Power Pruning ..... Mar., 1948
Mulch Is Good Orchard Practice ..... May, 1948
*Antibiotic fights Scab ..... May, 1948
*Low-Acid Peaches ..... May, 1948
Marketing Begins in the Field ..... Aug.-Sept., 1948
New Containers for Peaches ..... Aug.-Sept., 1948
Hormone Sprays ..... Dec., 1948

HAY

*Dries Wilted Hay ..... July, 1948
Better Buffalo Grass ..... Nov., 1948

HOGS

Swine Nutrition ..... Oct., 1948
Three-Litter Plan makes Money ..... Oct., 1948
*Hormone may boost Pig Production ..... Oct., 1948
Efficiency Test for Hogs ..... Nov., 1948
Better Swine Feeding Methods ..... Nov., 1948
Keep Them Growing ..... Nov., 1948
*Handling "Cannibal Sows" ..... Nov., 1948
Swine Type and Marketing Practices, ... Dec., 1948
Modern Swine Feeding Pays ..... Dec., 1948
Hog Mange ..... Jan., 1949
Livestock Feeding ..... Jan., 1949
Proteins for the Growing Pig ..... Feb., 1949
Care of Unborn Litters is Vital ..... Feb., 1949
*Hog Production Records ..... Feb., 1949

HORSES

Group Riding in California ..... Nov., 1947
New Killers for Livestock Pests ..... July, 1948
The Agriculture Remount Service ..... Oct., 1948

INSECTICIDES

Control of Cattle Parasites ..... Oct., 1948
New Test for Weevils ..... Nov., 1948
Parathion for Greenhouse Pests ..... Nov., 1948
Ohio's First Fly-Free County ..... Dec., 1948
Fly Resistance to DDT ..... Jan., 1949
Where Do New Insecticides Lead? ..... Jan., 1949

INSECTS

Hormones Reduce Insect Damage ..... June, 1947
Now Pest Damage Can Be Predicted ..... July, 1947
Destruction in the Dark ..... Aug.-Sept., 1947

PASTURES

Sudan Grass for Hog Pasture ..... Feb., 1948
Brome-Alfalfa Builds Beef ..... Feb., 1948
Grass Insurance ..... May, 1948
*Lupines for Grazing ..... May, 1948
Progress in Pastures ..... June, 1948
Stretch Your Pasture Season ..... June, 1948
Birdsfoot Trefoil ..... Aug.-Sept., 1948
Pasture Renovation Pays ..... Dec., 1948
Path to Profit is Grass Covered ..... Jan., 1949

POULTRY

Newcastle Vaccine Is Here ..... July, 1948
Oxygen Helps Them Hatch ..... July, 1948
Makes Broilers Grow Faster ..... Aug.-Sept., 1948
New Slant on Egg Washing ..... Oct., 1948
Cash Value of Turkey Manure ..... Oct., 1948
Why Does Deep Litter Work? ..... Nov., 1948
What is new in Equipment? ..... Nov., 1948
Chicken-of-Tomorrow Facts ..... Nov., 1948
Estrogen Fattens Turkeys Faster ..... Nov., 1948
Feeding Methods for Pullets ..... Nov., 1948
Baffle Boards Keep Litter Dry ..... Dec., 1948
*Crosses find their Niche ..... Dec., 1948
Breeder Selection ..... Jan., 1949
Why Deep Houses Are Better ..... Jan., 1949
Methods of Packaging Poultry ..... Jan., 1949
More Eggs in Top Grade ..... Jan., 1949
Chick Mortality ..... Feb., 1949
Steaks Sell Turkeys ..... Feb., 1949
So That Fewer Chickens Die ..... Feb., 1949
Electric Litter Stirrer ..... Feb., 1949

SHEEP AND GOATS

Brooders Help Save Lambs ..... June, 1948
The Way Animals Graze ..... Aug.-Sept., 1948
Your Sheep may need Cobalt ..... Oct., 1948
The Feeding of Milk Goats ..... Oct., 1948
Man's Best Friend in Greece ..... Oct., 1948
Full-Feed for Lambs ..... Nov., 1948
Sheep Research ..... Jan., 1949
"Elastration" ..... Feb., 1949
Lanolin-Ancient Beauty Aid ..... Feb., 1949

SOILS

Improve Soils with Organic Materials ..... Oct., 1948
Mulch Culture shows Promise ..... Oct., 1948
Soil and Proteins ..... Nov., 1948
Disinfecting Soils ..... Nov., 1948
*An Agricultural Revolution ..... Dec., 1948
Balance Your Soil Bank Account ..... Jan., 1949
Soil Fertility and Nutrition ..... Feb., 1949
Soil Doctrines ..... Feb., 1949
Soil That Breathes ..... Feb., 1949

VEGETABLES

Oil Spray for Weeding Carrots ..... Mar., 1948
Plant Spacing Affects Tomato Yields, ... July, 1948
*Hotbeds—Small Grower Doesn't Need Them, ... July, 1948
Mulching Vegetable Crops ..... Oct., 1948
Hormones for Tomatoes ..... Oct., 1948
*Sweet Potatoes ..... Jan., 1949

WEEDS

Fighting Weeds With Fire ..... Mar., 1948
Warren Co. Licked Wild Radish ..... Mar., 1948
Chemical Weed Control ..... June, 1948
Smother Crops ..... July, 1948
Chemical Warfare against Weeds ..... Nov., 1948

MISCELLANEOUS

Balanced Farming ..... Dec., 1948
Better Buy than Inherit a Farm ..... Dec., 1948
Rain by Telephone ..... Jan., 1949
Honey Hunting ..... Jan., 1949
Newsprint from Wheat Straw ..... Jan., 1949
Make Fence Posts Last Longer ..... Jan., 1949
Nutritional Anemia ..... Jan., 1949
Year-Around Stump Treatment ..... Jan., 1949
Up to $5,600 an Ounce ..... Feb., 1949
New Cleaning Materials ..... Feb., 1949
LPG Runs Farm Tractor ..... Feb., 1949
Farmers Under Our Feet ..... Feb., 1949
Is the Bounty System a Farce? ..... Feb., 1949

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"Spiritual power is a force which history clearly teaches has been the greatest force in the development of men. Yet we have been merely playing with it and have never really studied it as we have the physical forces. Some day people will learn that material things do not bring happiness and are of little use in making people creative and powerful. Then the scientists of the world will turn their laboratories over to the study of spiritual forces which have hardly been scratched."

—Charles P. Steinmetz